TAKAGI

T-K3 Instantaneous Water Heater

Service Manual

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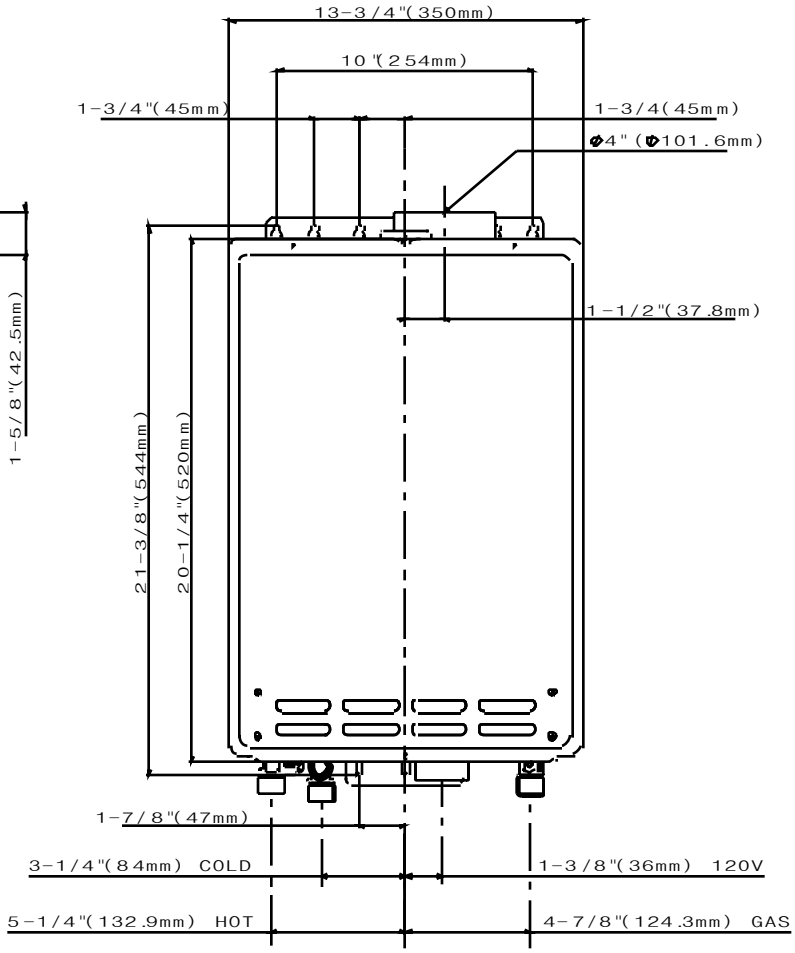
1. Specifications of the T-K3, T-K3-OS, and T-K3-SP

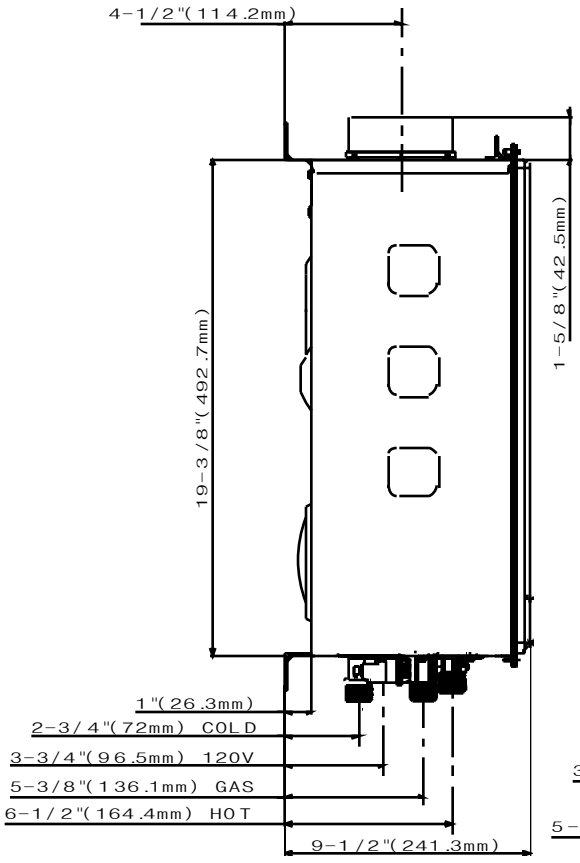
Model			T-K3	T-K3-OS	T-K3-SP
Dimensions			H20.5" ×W13.8" × D8.5"	H20.5" ×W13.8" × D8.5"	H20.5" ×W13.8" × D8.5"
Weight			40lbs.		
Combustion	INPUT BTU/h	Max	199,000	190,000	
		Min	11,000		
	Combustion System		Power vent		
	Installation		Indoor, Outdoor, & Direct-vent	Outdoor	Indoor & Outdoor
	Fan motor		PWM turbo fan	PWM fan	PWM turbo fan
	Manifold Pressure	Max	LP 4.4" WC Natural 2.5" W.C	LP 3.1" WC Natural 2.8" W.C	LP 4.1" WC Natural 2.4" WC
		Min	LP 0.7" WC Natural 0.4" WC	LP 0.8" WC Natural 0.4" WC	LP 0.8" WC Natural 0.4" WC
Water control	Flow rate		0.5 GPM to 7.0 GPM		
	Available set temperatures		99°F ~ 185°F default: 122°F	99°F ~ 167°F Default: 122°F	
	Temperature dipswitch settings		104°F, 113°F, 122°F, 131°F, 140°F, 158°F, 176°F, 185°F	113°F, 122°F, 140°F, 167°F	
	Bypass valve		Yes	N/A	
	Thermisters		3 thermisters (In,Out,Mixing)	2 thermisters (In,Out)	
Operation	Remote controller model		TM-RE10 TM-RE30	TK-RE02	
	PCB model		T-K3	T-K3 OS/SP	
	Indicators		"Burning" LED & 7-SEG LED	"Burning" LED	
	Power supply control		GFI (Including surge absorber)	Surge absorber & Power switch	
Features	Freeze protection		Ceramic heaters and Auto-firing system	Ceramic heaters	
	Self-combustion improvement		Air-Fuel Ratio Detection System		
	Easy-Link system		Yes	N/A	

2. Exterior view

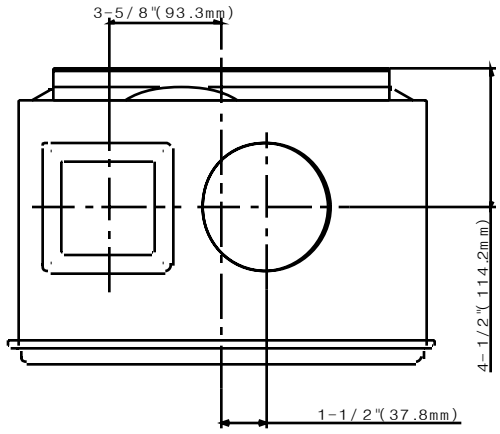
Front view



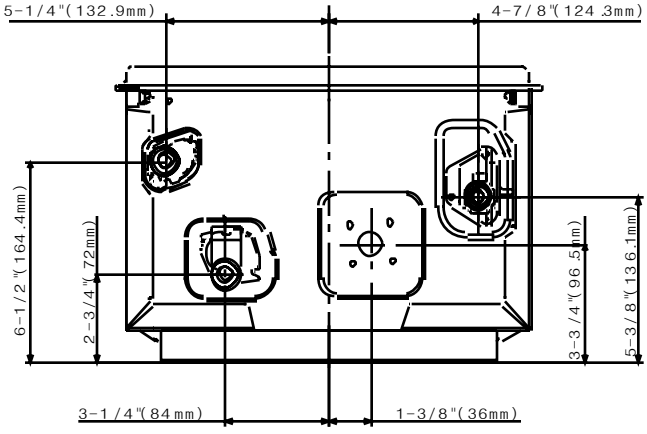
Side view



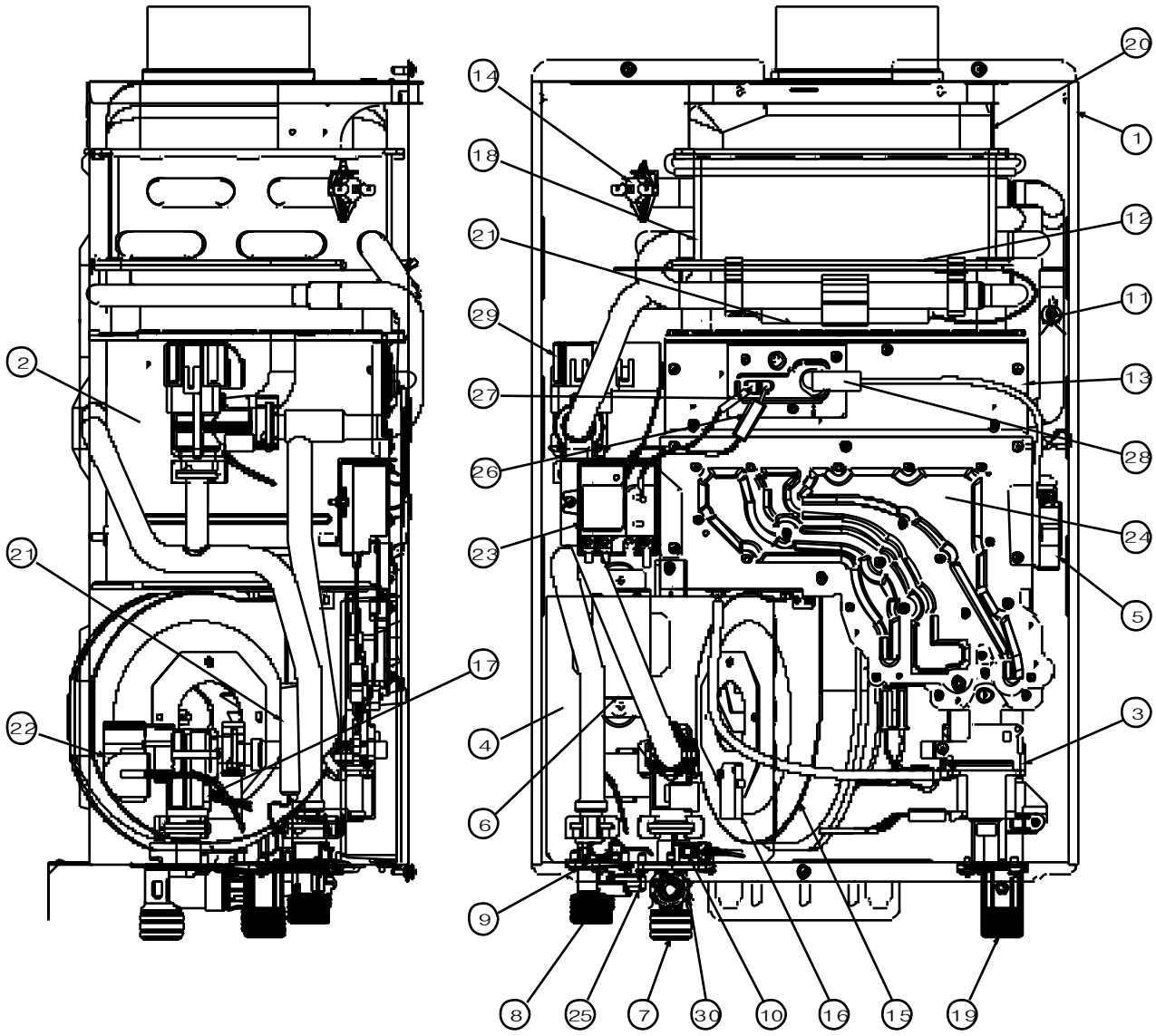
Top view



Bottom view



3. Interior view



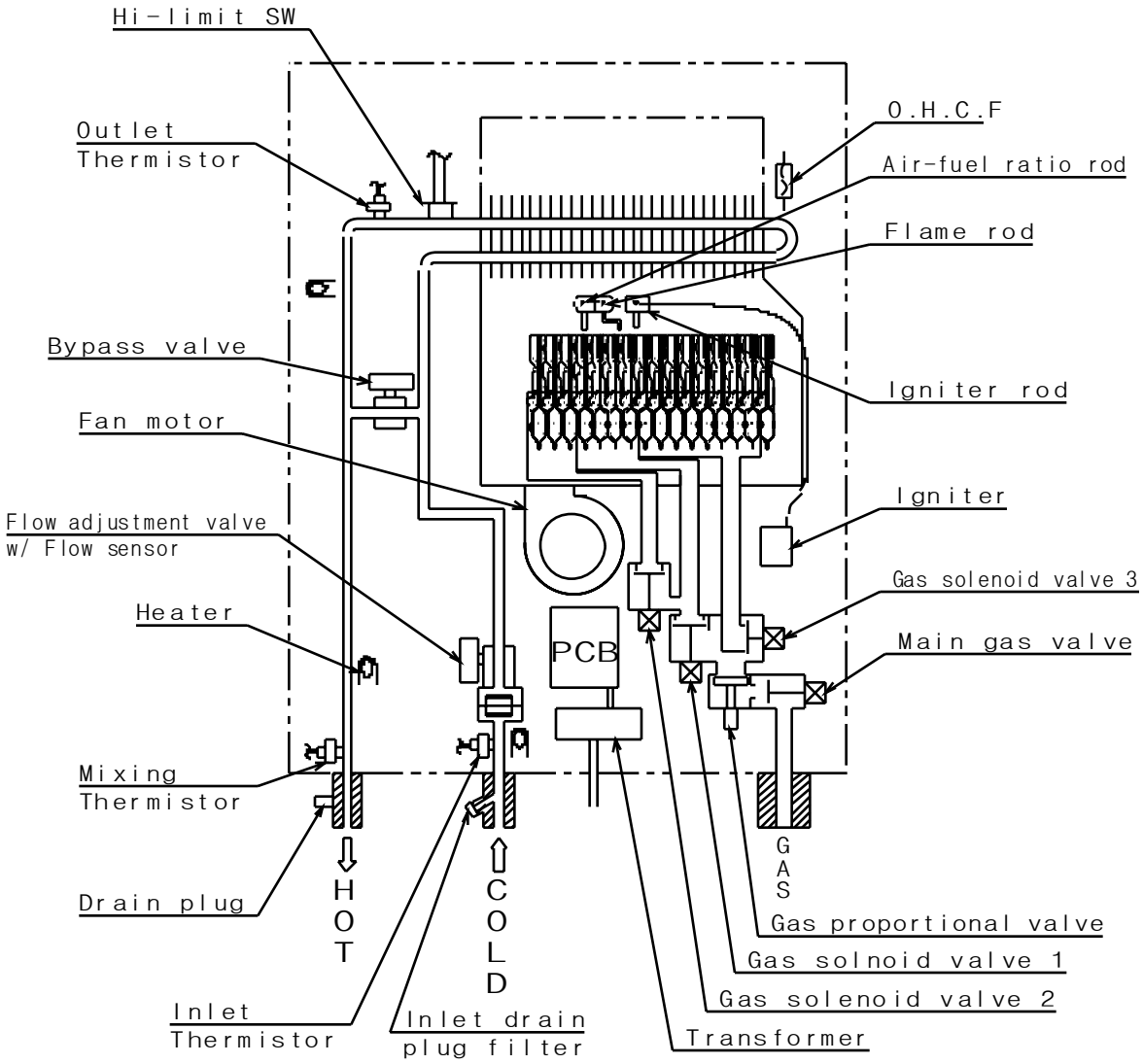
4. List of main components in the interior view

No.	Description	T-K3 Part#	Takagi Part #	Common parts For other units
1	Case assembly	001	EKK1D	SP
2	Combustion chamber	102	EKK1Y	SP
3	Gas valve with Proportional valve	105	EKK1W	OS, SP
4	Computer board	701	EKK1L	
5	Igniter	704	EKN74	TKJr, TK1S, TH1, OS, SP

4. List of main components in the internal view (cont'd)

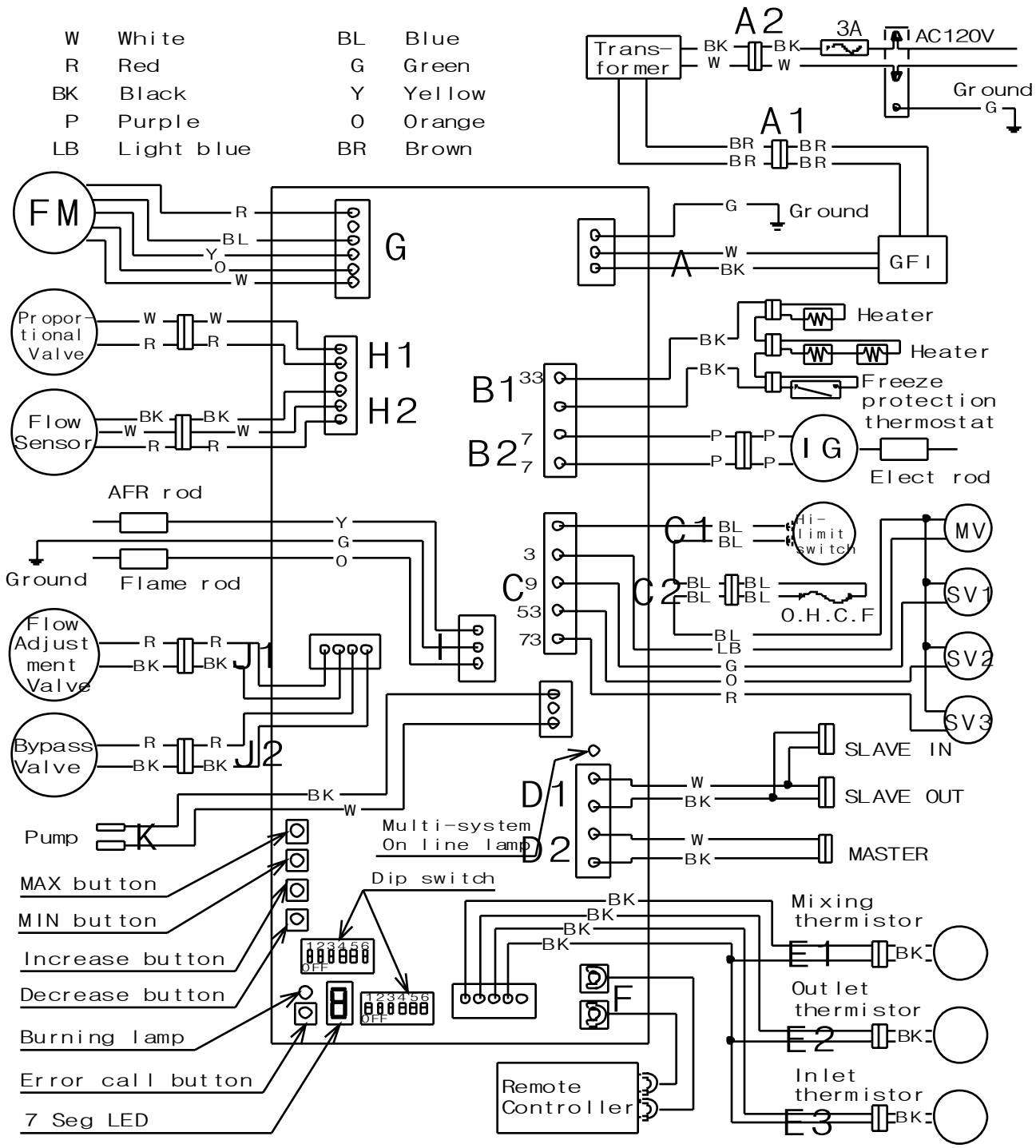
No.	Description	T-K3 Part#	Takagi Part #	Common parts with other models
6	Transformer	702	EKH09	TH1, OS, SP
7	Water inlet	404	EKK1U	OS, SP
8	Water outlet	405	EKK1V	OS, SP
9	Mixing thermistor	408	EKK1A	
10	Inlet thermistor	406	EKK38	
11	Outlet thermistor	407	EKK2T	
12	Overheat cut-off fuse	411	EKK0S	
13	Burner assembly (Burners)	101	EKK1N	OS, SP
14	Hi-limit switch	409	EKN34	TKJr, TK1S, TH1, OS, SP
15	Fan motor	104	EKK25	SP
16	Freeze protection thermostat	705	EKJ59	TK2, TK1S, OS, SP
17	Flow sensor	402	EKK0T	
18	Heat exchanger	401	EKK1X	SP
19	Gas inlet	108	EKK1E	OS, SP
20	Exhaust	401	EKK1X	
21	Heater	412	EKK2R	OS, SP
22	Flow adjustment valve	402	EKK0T	
23	GFI	703	EKN73	TK1S, TKJr, TH1
24	Manifold	103	EKK1T(NA) EKK1S(LP)	OS, SP
25	Outlet drain plug	419	EKK2E	OS, SP
26	Air-fuel ratio rod (AFR rod)	716	EKK0E	OS, SP
27	Flame rod	716	EKK0E	OS, SP
28	Igniter rod	107	EKK0F	OS, SP
29	Bypass valve	403	EKK0U	
30	Inlet drain plug	416	EKK2B	OS, SP

5. Schematic diagram



1. When a hot water tap is opened, cold water enters the T-K3 water heater.
2. The water flow sensor detects this water flow and sends this information to computer.
3. The computer initiates fan motor and sends signal to igniter to create ignition spark.
4. The main, proportional, and solenoid gas valves open to allow gas input.
5. The gas ignites and flames appear inside the burner chamber.
6. Water circulates through the heat exchanger and is heated up to the set temperature.
7. Using thermistors to measure temperatures, the computer modulates the gas and water valves to ensure proper output water temperatures.
8. When the tap is closed, the T-K3 water heater shuts down.

6. Wiring diagram



7. Wiring diagram check points for diagnosis

Check-point	Part and Description	Color of wires	Normal range
A, A1	100V Power supply	Brown – Brown (A1) White – Black (A)	AC 90～110V
A2	120V Power supply	Black - White	AC 108～132V
B1	Heater	Black - Black	AC 90～110V
B2	Igniter	Purple - Purple	AC 90～110V
C	Gas valves	Light blue - blue at COM	DC 78~100V(in operation) / 0.9~1.3kΩ
		Green - blue at COM	DC 78~100V(in operation) / 1.3~1.9kΩ
		Orange - blue at COM	DC 78~100V(in operation) / 1.3~1.9kΩ
		Red - blue at COM	DC 78~100V(in operation) / 0.9~1.7kΩ
C	Proportional Valve	White - red at COM	DC 1~10V(in operation) / 30~51Ω
C1	Hi-limit switch	Blue - Blue	Less than DC 1V and less than 1.3 Ω
C2	Overheat cutoff fuse	Blue - Blue	Less than DC 1V and less than 1.3 Ω
D1	Easy link connectors	Black - White	DC 15V (during Easy-Link operation)
D2		Black - White	DC 15V
E1	Mixing thermistor	Black - Black	See table on p. 10
E2	Outlet thermistor	Black - Black	
E3	Inlet thermistor	Black - Black	
F	Remote controller	*	DC 11～25V
G	Fan motor	Red - Blue	DC 110～160V
		Yellow - Blue	DC 13～17V
		Orange - Blue	DC 2～6.5V
		White - Blue	See the “A
H1	Gas proportional valve	White - red	DC 1～10V and 30～50 Ω
H2	Flow sensor	Red - Black	DC 4～5.5V
		White - Black	DC 1～4V (1080pulse / min)
I	Air-fuel ratio flame rod	Yellow - AFR rod	More than 1 μA (during burning)
	Flame rod	Orange - Flame rod	More than 1 μA (during burning)
J1	Flow adjustment valve	Red - Black	DC 7～16V and 0.09～0.2kΩ
J2	Bypass valve	Red - Black	DC 7～16V and 0.09～0.2kΩ
K	Pump connector port	White - Black	Less than 1.3 Ω

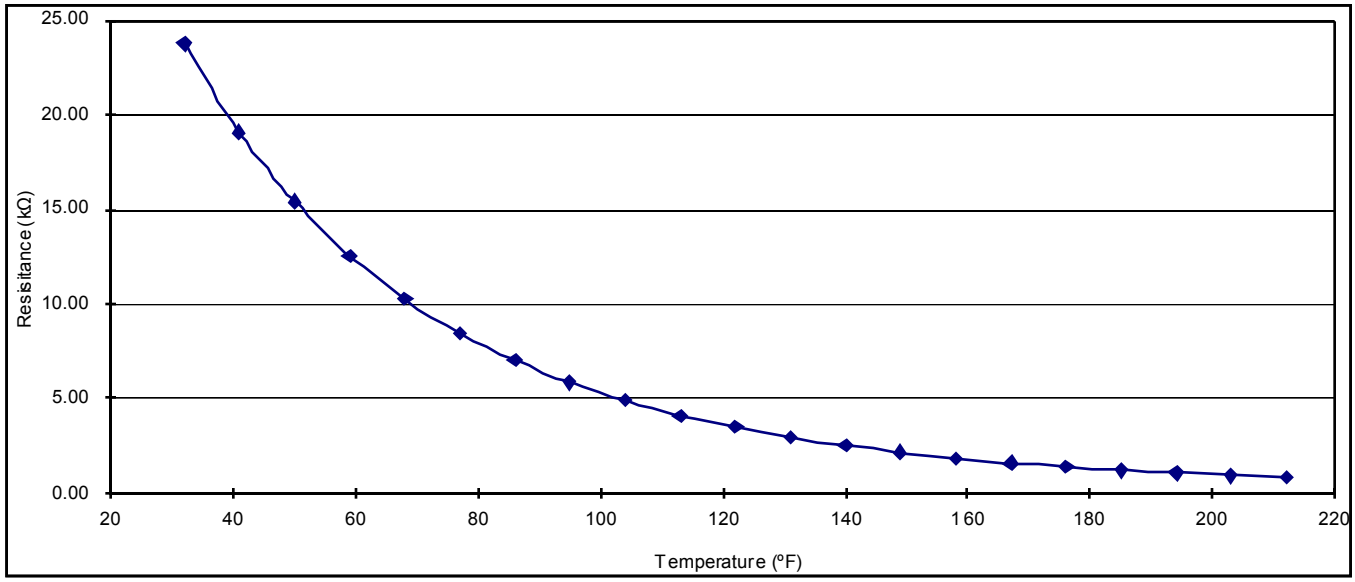
8. Resistance values of the temperature thermistors

Resistance values at different temperatures

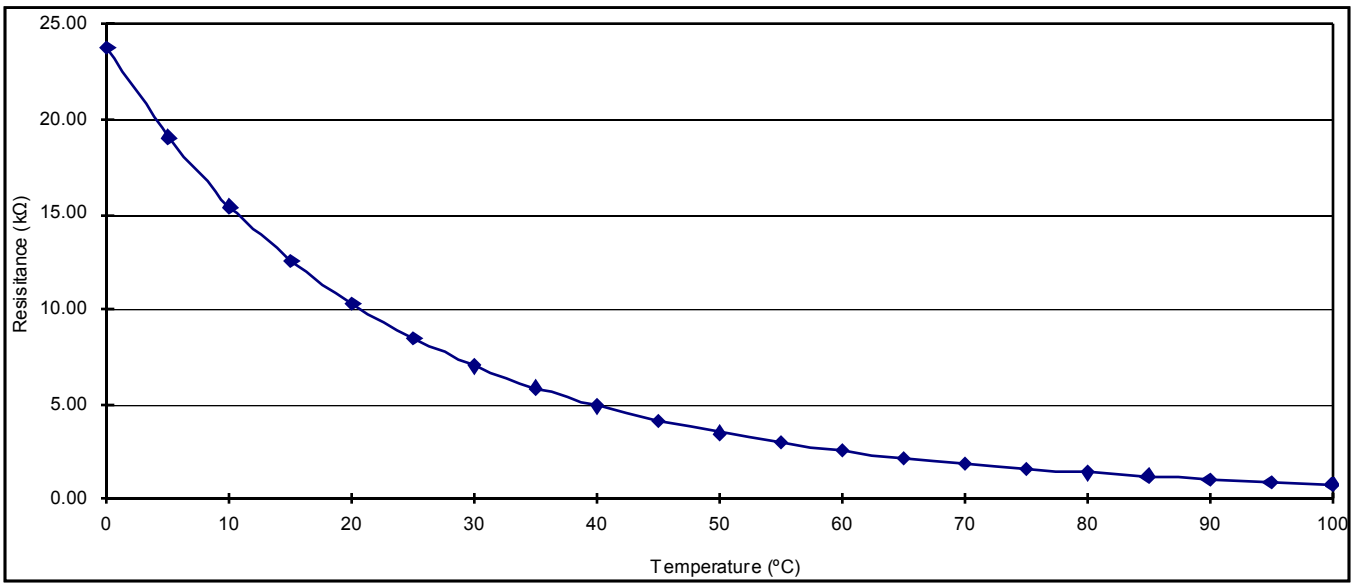
Temperature	ºF	32	41	50	59	68	77	86	95	104	113
	ºC	0	5	10	15	20	25	30	35	40	45
Resistance	kΩ	23.76	19.08	15.43	12.56	10.28	8.47	7.02	5.85	4.90	4.12

Temperature	ºF	122	131	140	149	158	167	176	185	194	203	212
	ºC	50	55	60	65	70	75	80	85	90	95	100
Resistance	kΩ	3.49	2.96	2.53	2.16	1.86	1.60	1.39	1.21	1.05	0.92	0.81

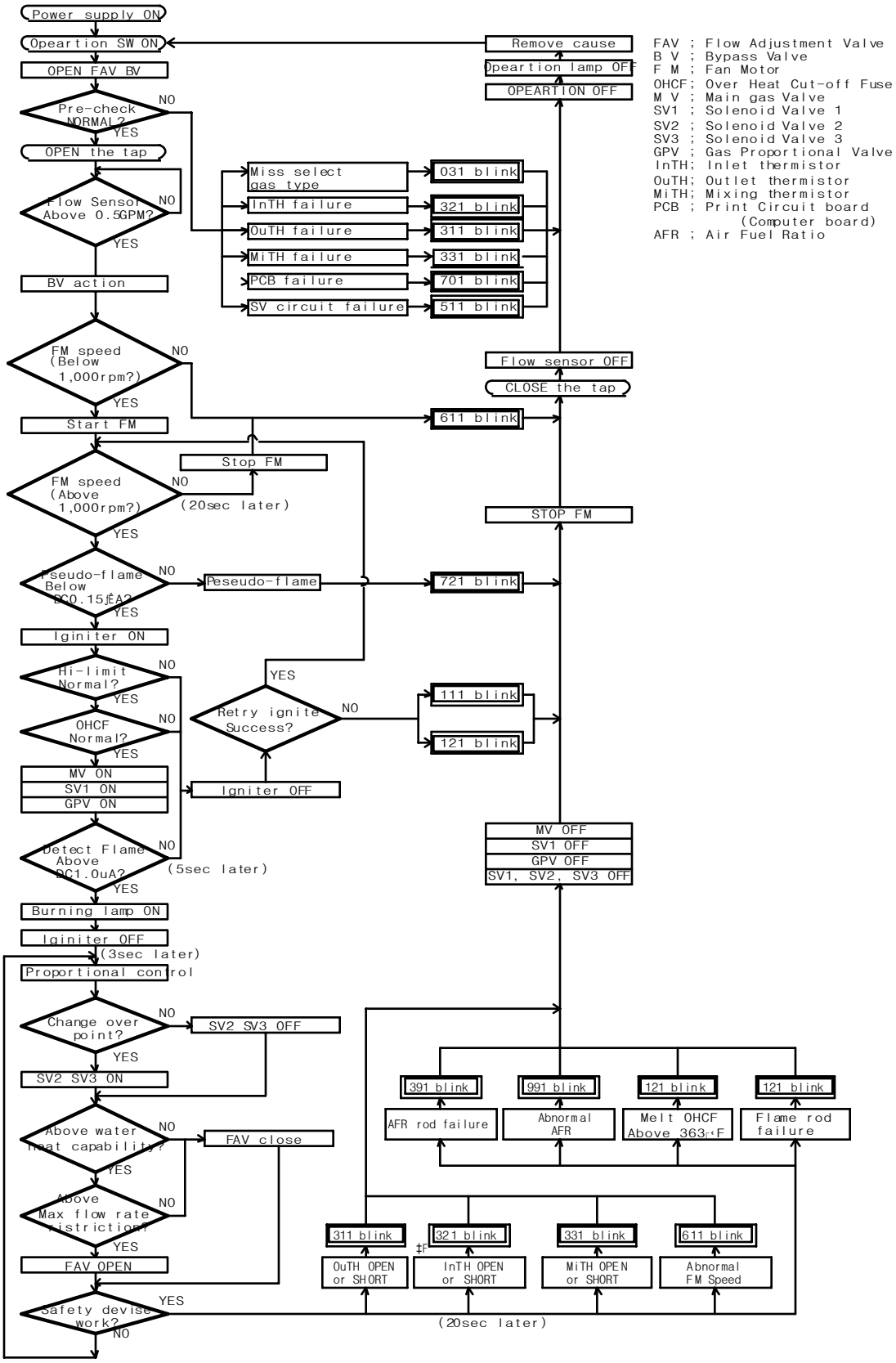
Temperature(ºF) vs. Resistance(kΩ)



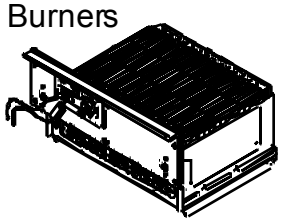
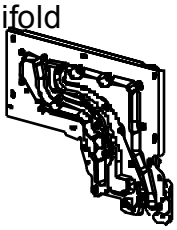
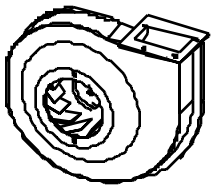
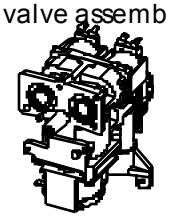
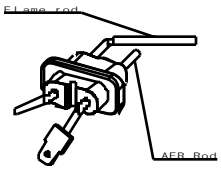
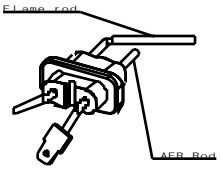
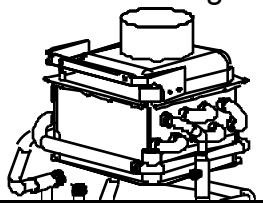
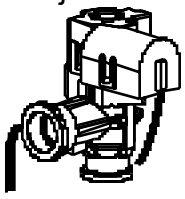
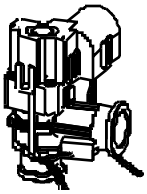
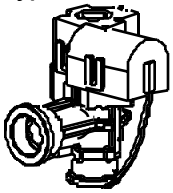
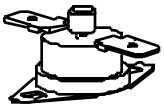
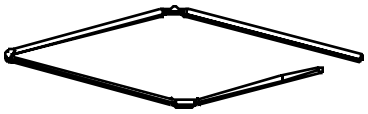
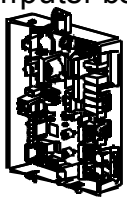
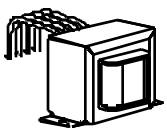
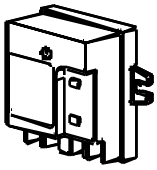
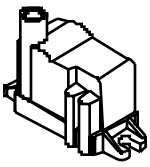
Temperature(ºC) vs. Resistance(kΩ)



9. Operational flow chart

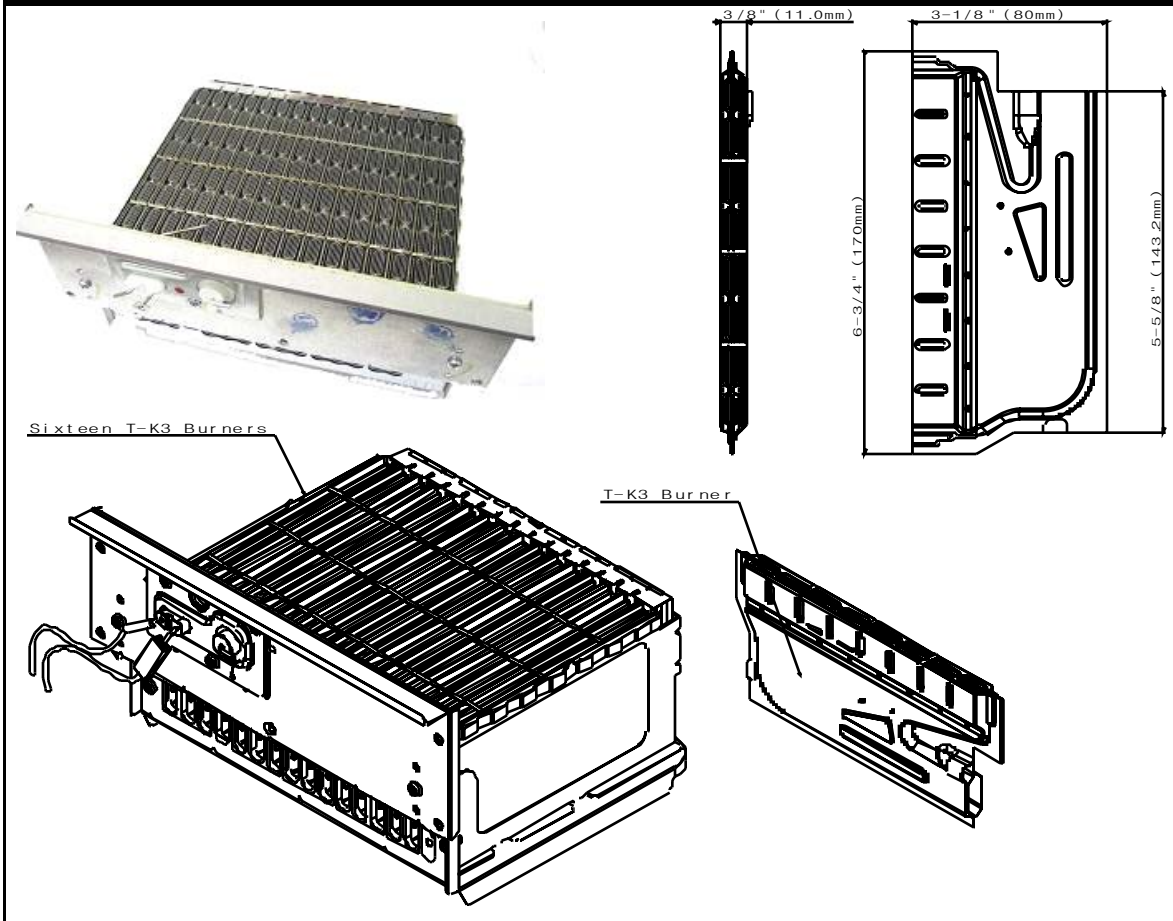


10. Component specifications

1. Burners  P.13	2. Manifold  P.14	3. Fan motor  P.15
4. Gas valve assembly  P.16	5. Flame rod  P.17	6. AFR rod  P.18
7. Heat exchanger  P.19	8. Flow adjustment valve  P.20	9. Flow sensor  P.21
10. Bypass valve  P.22	11. Thermistors P.23	12. Hi-limit switch  P.24
13. Overheat cutoff fuse  P.25	14. Heaters P.26	15. Computer board  P.27
16. Transformer  P.28	17. GFI  P.29	18. Igniter  P.30
19. Freeze protection thermostat P.31		

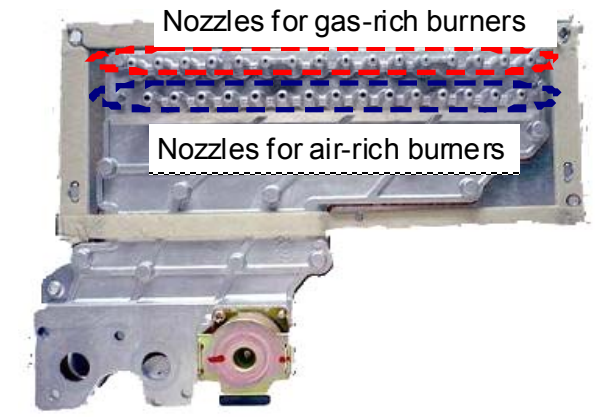
10-1. Burners

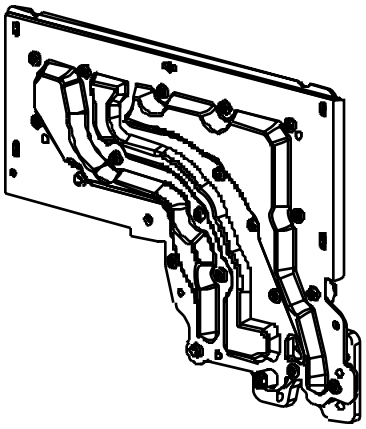
T-K3 Part #	#101	Takagi Part #	EKK1N	Checkpoint	N/A
Function	There are 2 types of burners in the T-K3: the gas-rich burner stabilizes the flames within the combustion chamber and the air-rich burner produces more heat in the combustion chamber. The burners facilitate the air/gas mixture necessary to produce the proper heat during the combustion reaction.				
Failure events	1. Unable to initialize/sustain combustion 2. Dust or soot deposit on the burner surface. 3. Cracks on the burners. 4. Gas leakage from burners				
Effects on the T-K3 if burners fails	1. An unexpected combustion. 2. Unstable flame conditions and/or flame loss. 3. Ignition failure.				
Error codes when the burners fail	**111**		**121**		
Diagnostic	Visual inspection: excessive dust deposit on the burner surface and/or unstable flame conditions during operation.				
Color/Number of wires	**N/A**				

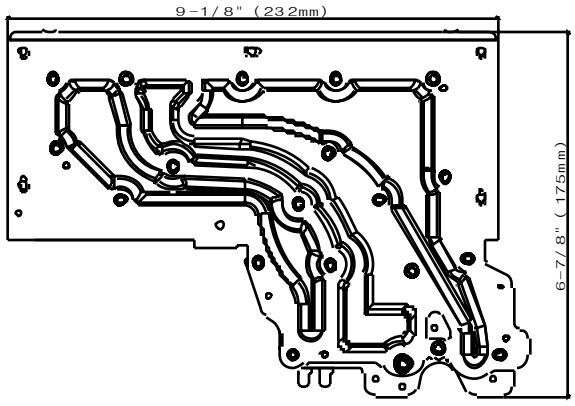


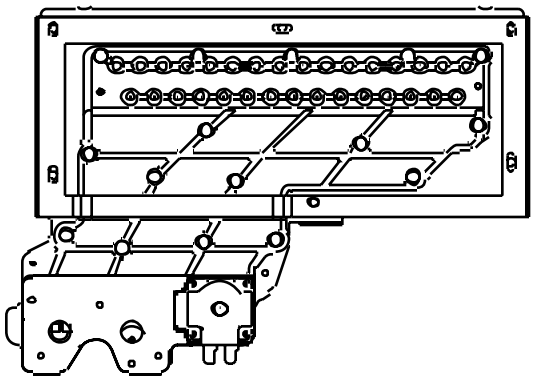
10-2. Gas manifold

T-K3 Part #	#103	Takagi Part #	EKK1F	Checkpoint	N/A
Function	1. The manifold distributes gas from the gas valves to the burners. The manifold has two types of the nozzles: one type for gas-rich burners (16 nozzles) and the other for air-rich burners (15 nozzles) 2. There are 3 zones within the manifold, to ensure efficient combustion operation.				
Failure events	1. Dust deposit on the manifold. 2. Gas leakage from a failed manifold. 3. Ignition failure. 4. Imperfect combustion.				
Effects on the T-K3 if the manifold fails.	1. The burners cannot receive proper gas flow from the manifold, which can cause poor combustion in the combustion chamber. In this case, the AFR rod will detect an improper flame condition and computer will take safety measures. 2. Gas leakage from the manifold.				
Error codes when the manifold fails.	**111**		**121**		
Diagnostic	1. Visual inspection: Excessive dust deposit around the nozzles or cracks on the manifold. 2. Check voltages and resistance: proper range of values shown below.				
Color/Number of wires	Blue -Red		DC 78~100V / 0.9~1.7kΩ		



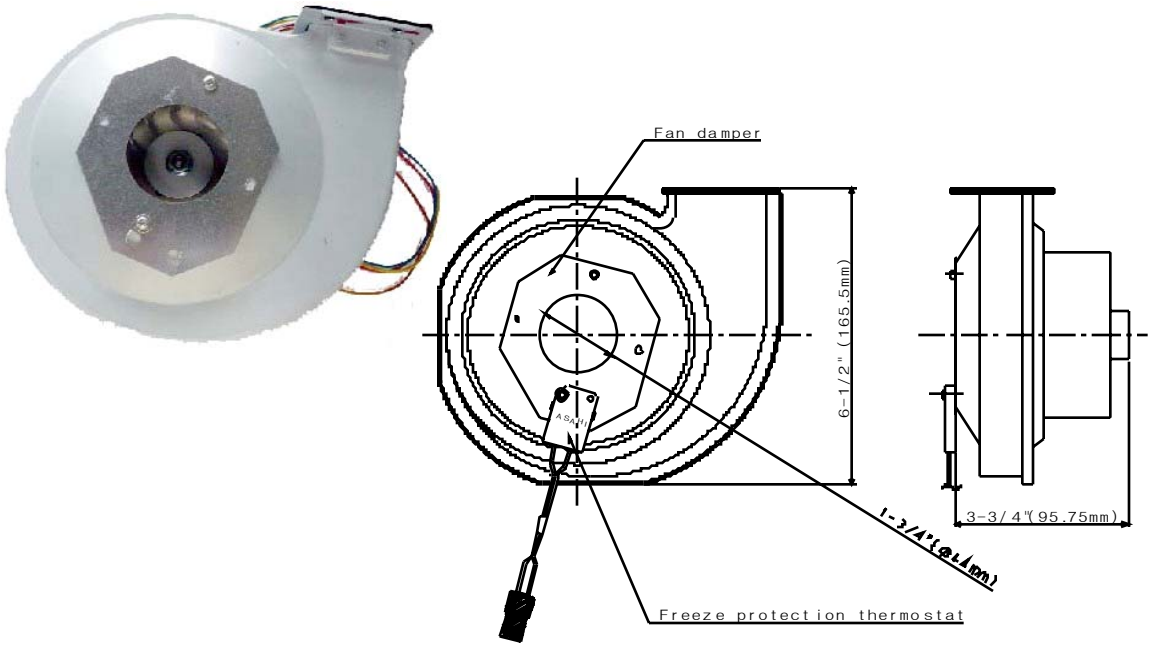






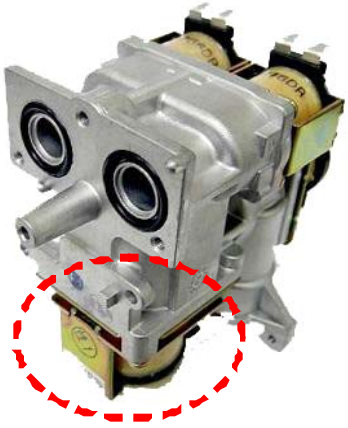
10-3. Fan motor

T-K3 Part #	#104	Takagi Part #	EKK25	Checkpoint	G
Function	To provide combustion air into the burner chamber and to exhaust flue gas.				
Failure events	1. Fan speed failure, causing abnormal sounds with or without combustion in the operation. 2. Unexpected working caused by the connectors of the fan motor getting wet. 3. Drops out from the bottom of the combustion chamber				
Effects on the T-K3 if fan motor fails	1. T-K3 does not function properly 2. Failure to ignite or abnormal ignition 3. Unstable combustion conditions				
Error codes when the fan motor fails.	**611**				
Diagnostic	1. Visual inspection: connection/breakage of wires or dust (causing electrical shortage) 2. Voltage check: proper range of voltages shown below.				
Color/Number of wires	Red-Blue	DC 110~160V (Input)			
	Yellow-Blue	DC 13~17V (Input)			
	Orange-Blue	DC 2.0~6.5V (Input)			
	White-Blue	Verify the fan motor speed using the Diagnostics Mode of the TM-RE10 temperature remote controller. See Section 12-1 for details.			

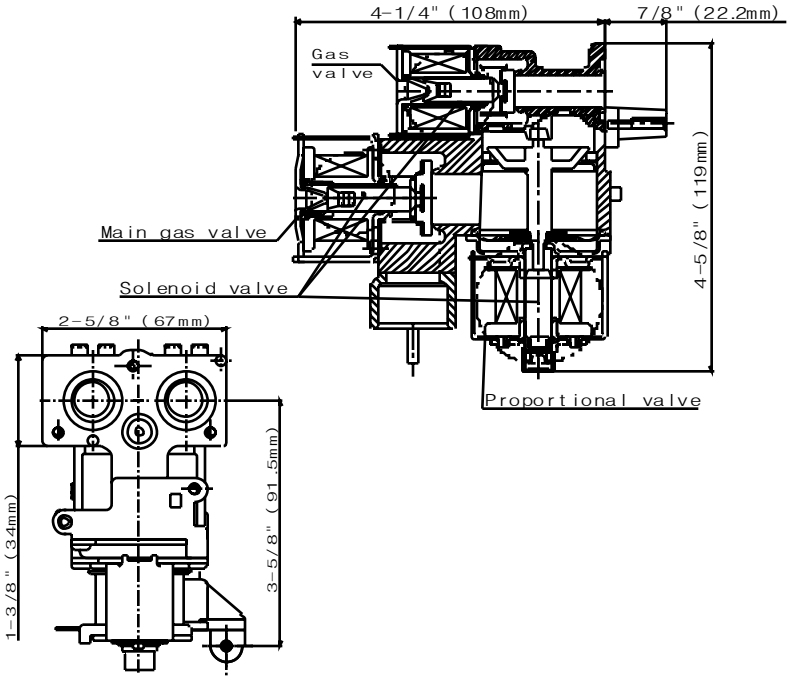


10-4. Gas valve assembly

T-K3 Part #	#105	Takagi Part #	EKK1W	Checkpoint	C,H1
Function	Opens and closes the gas pathways of the T-K3 (main and solenoid gas valves)				
	Modulates the gas flow from the gas inlet (proportional gas valve)				
Failure events	1. Gas leak from the valves. 2. Unable to open/close (main and solenoid gas valves) 3. Unable to modulate the gas flow (proportional gas valve)				
Effects on the T-K3 if valves fails.	1. Gas leak from the unit. 2. Excess carbon monoxide emissions. 3. Lack of water temperature control. 4. No flames				
Error codes when the valves fail.	**111**	**121**	**510**	**701**	**711**
Diagnostic	1. Visual inspection: connection/breakage of wires. 2. Listen for "clunk" sounds from the gas valves opening right after fan motor initiates. 3. Check voltages and resistance of coils; proper range of values shown below.				
Color/Number of wires	Blue -Red	DC 78~100V / 0.9~1.7KΩ			
	Blue -light blue	DC 78~100V / 0.9~1.3KΩ			
	Blue -Orange	DC 78~100V / 1.3~1.9KΩ			
	Blue -Green	DC 78~100V / 1.3~1.9KΩ			
	White - Red (Proportional Valve)	DC 1~15V / 20~40Ω			



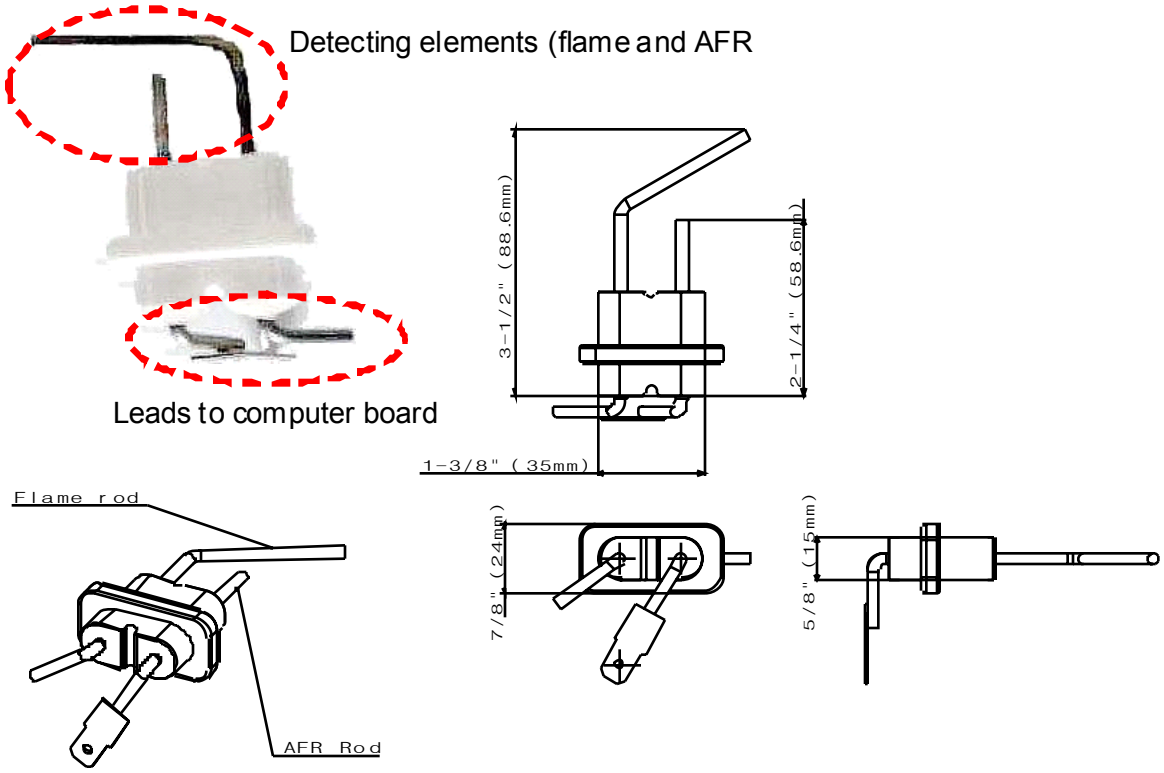
Proportional Valve



10-5. Flame rod

T-K3 Part #	#716	Takagi Part #	EKK0E	Checkpoint	I
Function	To detect flames while unit is in operation.				
Failure event	1 Unable to detect flames when flames actually do occur 2. Detecting a false flame when no flames actually occur				
Effects on the T-K3 if flame rod fails	1. The T-K3 stops operating. The "111" and/or "121" error code(s) will display 2. The T-K3 will not initiate the ignition process. The "721" error code will display				
Error codes when the flame rod fails.	**111** **121** **721**				
Diagnostic	1. Visual inspection: connection/breakage of wires or soot buildup on rod. 2. Check amperes: proper range of values shown below.				
Color/Number of wires	Orange(17) - Green(18) (during combustion) 40KHz~60KHz Orange(17) - Flame rod between the flame rod and the computer board (during combustion) 1μA or more				

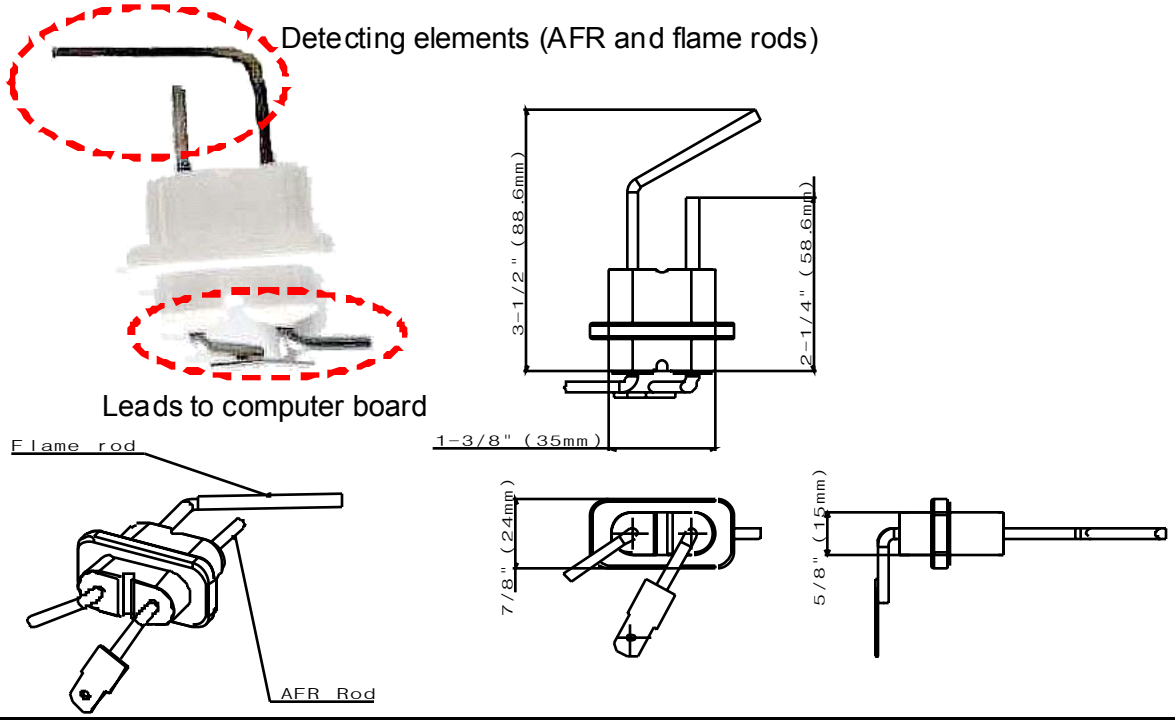
The flame rod is assembled with the AFR rod.



10-6. AFR rod

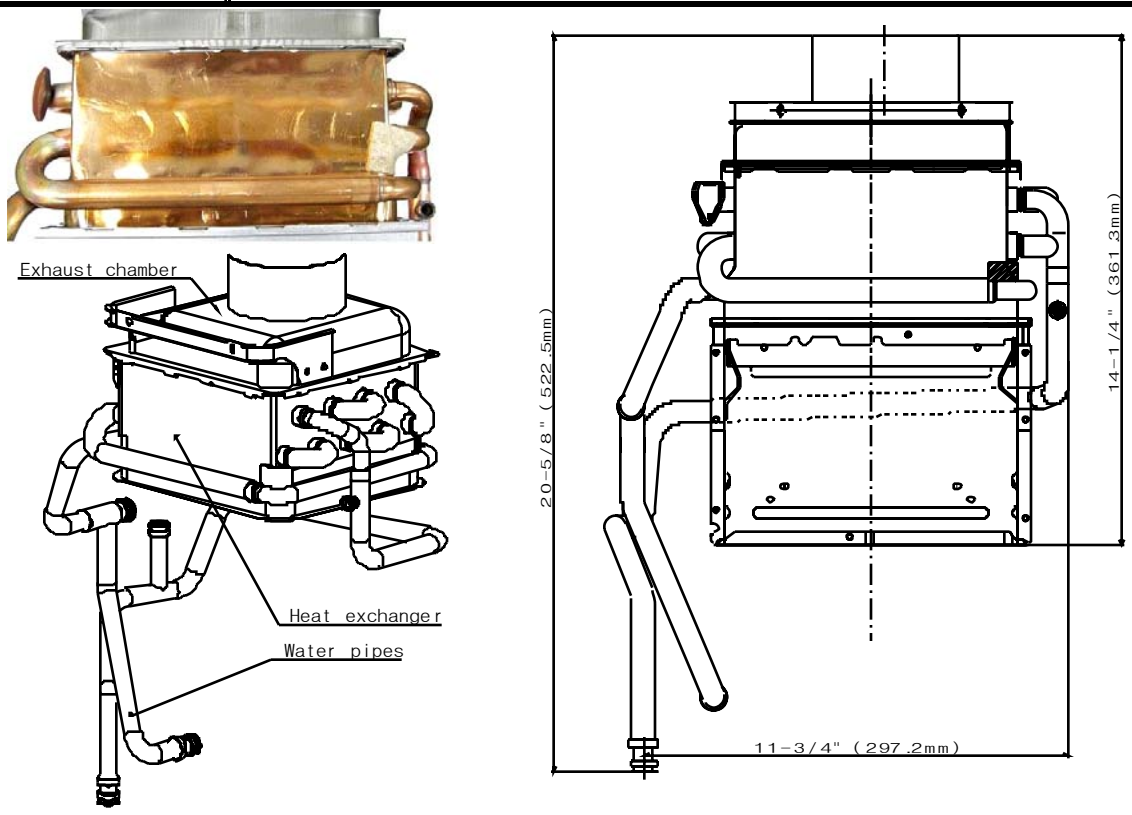
T-K3 Part #	#716	Takagi Part #	EKK0E	Checkpoint	I
Functions	-Checks flame conditions during combustion. -When AFR rod detects unexpected flame conditions, the T-K3's computer makes adjustments in the fan motor speed to compensate.				
Failure event	1. Unable to detect flames when flames actually do occur 2. Detecting a false flame when no flames actually occur				
Effects on the T-K3 if the AFR rod fails	1. The T-K3 stops operating. The "111" and/or "121" error code(s) will display 2. The T-K3 will not initiate the ignition process. The "721" error code will display 3. The fan motor speed cannot be modulated properly under abnormal flame conditions, which can result in excessive CO emission.				
Error codes when the AFR rod fails.	**101**	**991**	**391**		
Diagnostic	1. Visual inspection: connection/braking of wires, soot on it. 2. Check voltages: proper range of values are shown below.				
Color/Number of wires	Yellow (8) - Green (18)	(during operation) 40KHz~60KHz			
	Yellow (8) - AFR rod: between the AFR rod and the computer board	(during operation) 1μA or more			

The AFR rod is assembled with the flame rod.



10-7. Heat exchanger

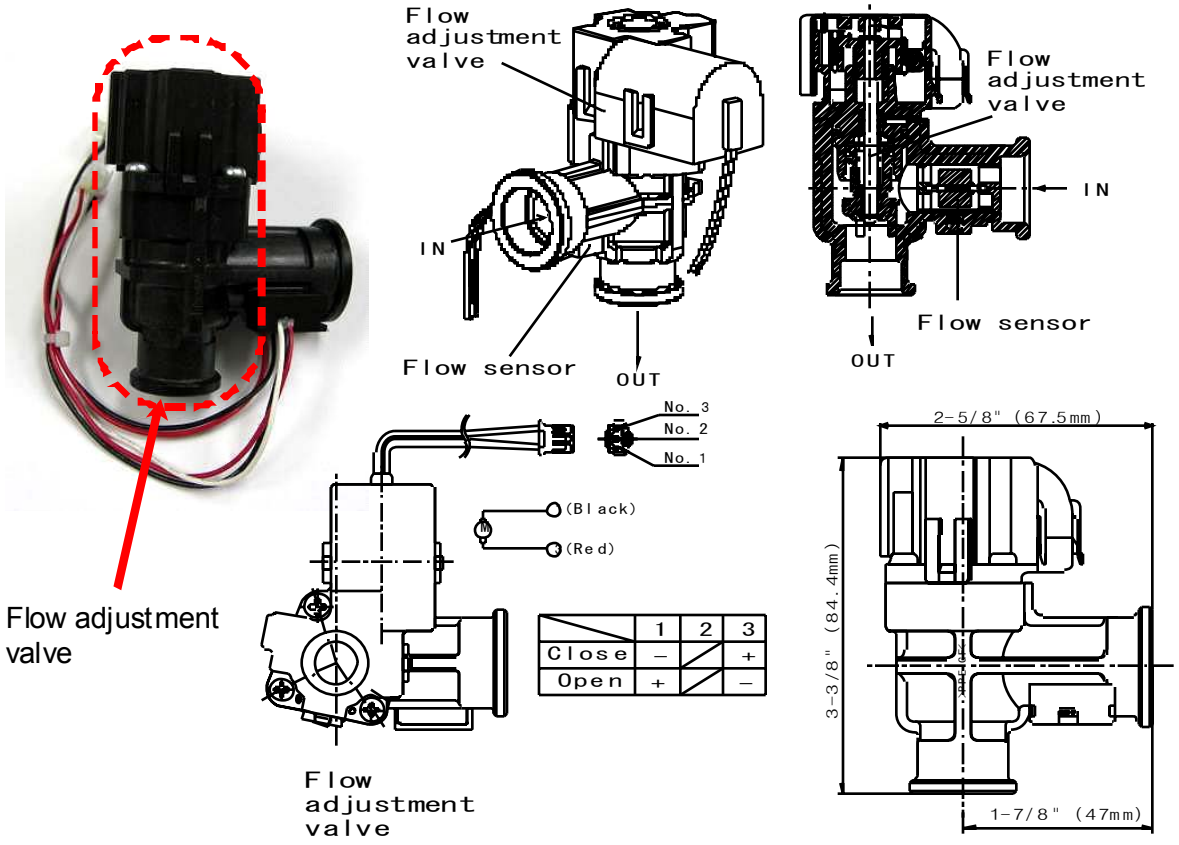
T-K3 Part #	#401	Takagi Part #	EKK1X	Checkpoint	N/A
Function	Absorb heat from combustion and transfer it to water through the heat exchanger pipes.				
Failure event	1. Clogged heat exchanger fins and/or cracks on the heat exchanger walls. 2. Leaking exhaust gas. 3. Improper heat transfer can cause the water in heat exchanger to boil.				
Effects on the T-K3 if the heat exchanger fails.	1. Water leakage from the heat exchanger 2. Exhaust gas leakage (if this occurs, an overheat cutoff fuse is in place to detect this event and immediately stop the T-K3 from operating) 3. Abnormal sounds during combustion				
Error codes when the heat exchanger fails.	**N/A**				
Diagnostic	1. Visual inspection: soot deposits, cracks on the heat exchanger walls, and/or water leakage from the heat exchanger. 2. In the event of abnormal sounds during combustion: A. Inspect for soot buildup inside the heat exchanger. B. Inspect for scale buildup inside the heat exchanger pipes. Scale buildup obstructs proper heat transfer to the water, thereby overheating the heat exchanger and causing damage.				
Color/Number of wires	**N/A**				



10-8. Flow adjustment valve

T-K3 Part #	#402	Takagi Part #	EKK0T	Checkpoint	J1
Function	Controls water flow to properly control the output hot water temperaturet.				
Failure event	1. Water leakage from valve. 2. The valve cannot modulate or make open/close positions.				
Effects on the T-K3 if flow adjustment valve fails	1. Water leakage from failed valve can damage other T-K3 components. 2. Temperature fluctuations in the hot water output. 3. Within a multi-unit Easy-Link system, the "651" error code can occur.				
Error codes when Flow Adjustment Valve fails.	**651 (only within multi-unit Easy-Link systems)**				
Diagnostic	1. Visual inspection: connection/breakage of wires, motor drive locked due to scale buildup, and/or water leakage. 2. Check voltages and resistance; proper range of values shown below.				
Color/Number of wires	Black-Red DC7~16V and 0.09~0.2kΩ				

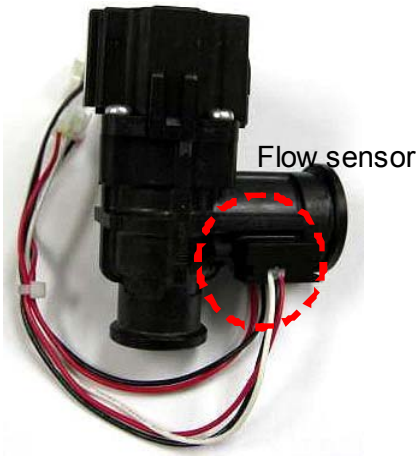
The flow adjustment valve is assembled with the flow sensor.

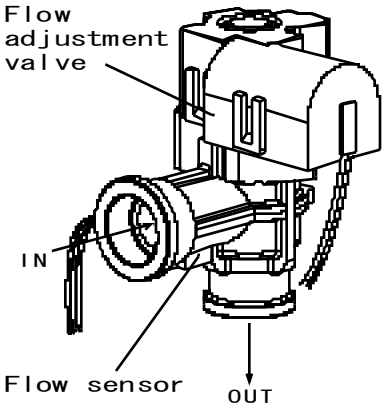


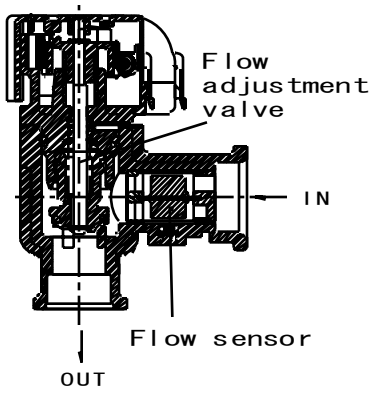
10-9. Flow sensor

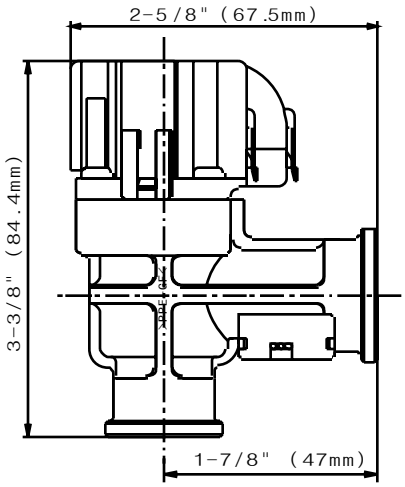
T-K3 Part #	#402	Takagi Part #	EKK0T	Checkpoint	H2
Function	Detects and measures water flow rate using a spinning impeller and magnetic pick-				
Failure event	Unable to detect or measure any water flow rate.				
Effects on the T-K3 if flow sensor fails	Ignition sequence does not start (T-K3 will not initiate any operation)				
Error codes when the flow sensor fails.	**441 (only within multi-unit Easy-Link systems)**				
Diagnostic	1. Visual inspection: connection/breakage of wires and/or debris on impeller 2. Check voltages: proper range of values shown below.				
Color/Number of wires	Red-Black DC 4~5.5V (Input)				
	White(85)-Black DC 1~4V (pulse) 1,080 pulse/min (more than 18Hz)				

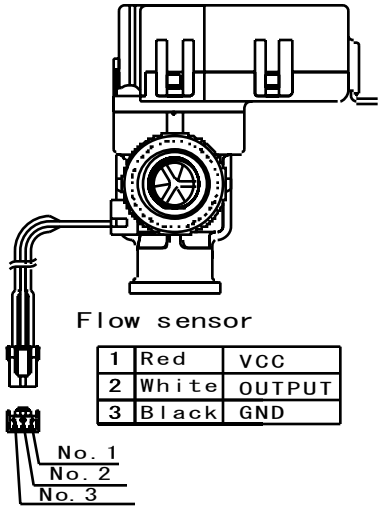
The flow sensor is assembled with the flow adjustment valve.







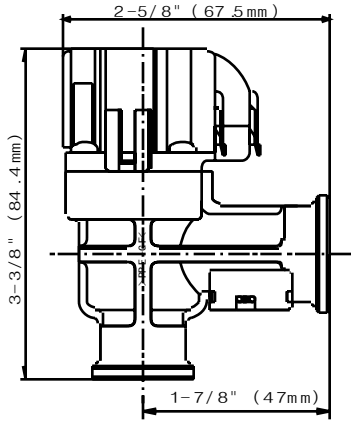


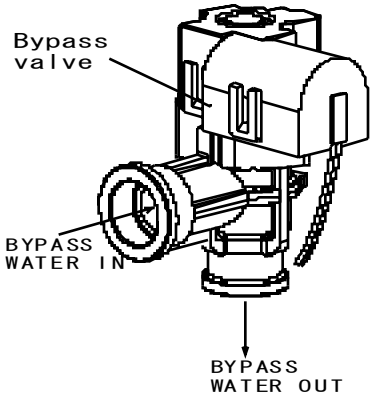


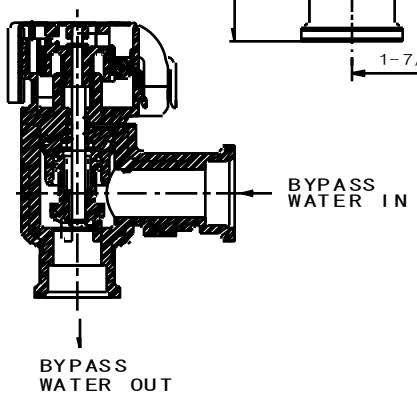
10-10. Bypass valve

T-K3 Part #	#403	Takagi Part #	EKK0U	Checkpoint	J2
Function	1. Mixes hot water from the heat exchanger with cold water from the water inlet in order to modulate and control the T-K3's outlet water temperature. 2. Keeps the water temperature in the heat exchanger stable, preventing low-temperature corrosion by reducing condensation buildup in heat exchanger.				
Failure event	1. Water leakage from valve. 2. The valve cannot modulate or make open/close positions.				
Effects on the T-K3 if the bypass valve fails	1. Water leakage from failed valve can damage other T-K3 components 2. Temperature fluctuations in the hot water output.				
Error codes when bypass valve fails.	**N/A**				
Diagnostic	1. Visual inspection: connection/breakage of wires. 2. Check voltages and resistance: proper range of values shown below.				
Color/Number of wires	Red - Black DC7~16V and 0.09~0.2kΩ				

The physical appearance of the bypass valve is similar to that of the flow adjustment valve. However, their functions differ and cannot be substituted for each other.

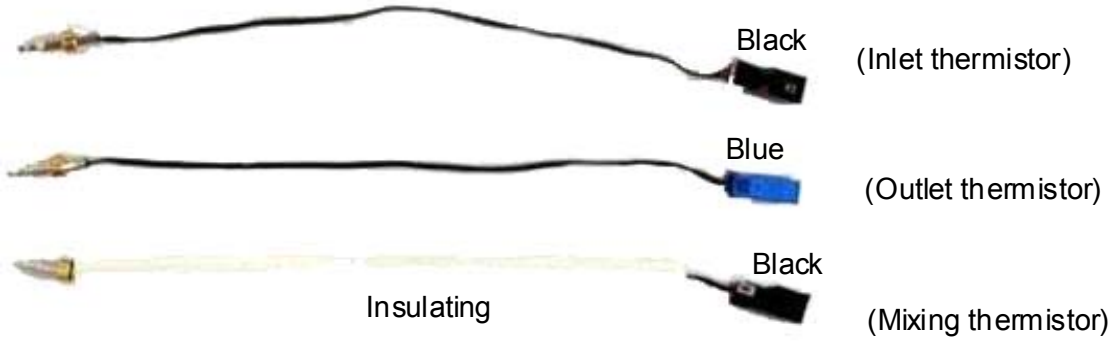




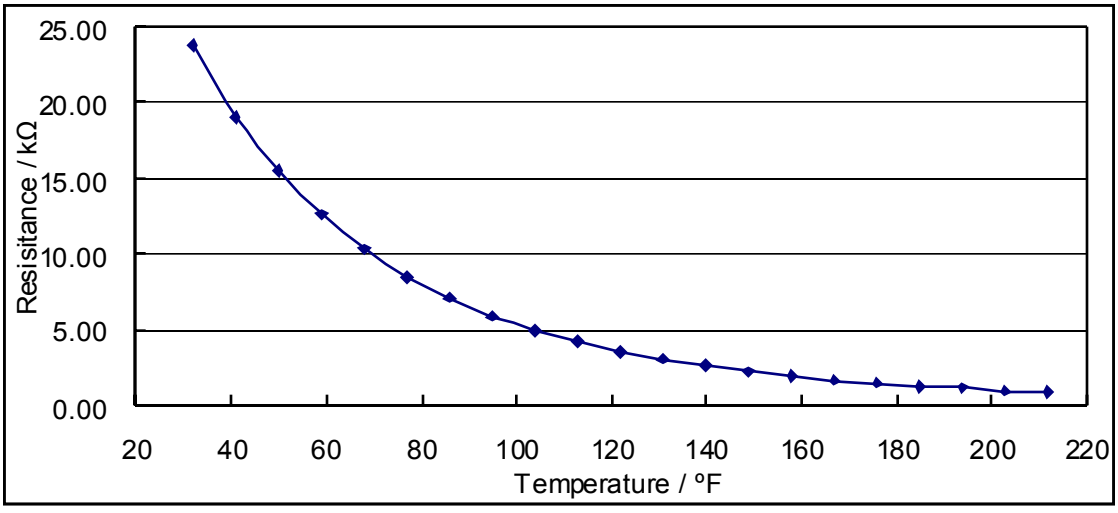


10-11. Thermistors

T-K3 Part #	#406 (Inlet) #407 (Outlet) #408 (Mixing)	**Takagi Part #**	EKK38 (Inlet) EKK2T (Outlet) EKK1A (Mixing)	**Checkpoint**	**E1 (Mixing)** **E2 (Outlet)** **E3 (Inlet)**
Function	Measure cold/hot water temperatures in the T-K3.				
Failure event	Unable to properly measure water temperatures within the T-K3.				
Effects on the T-K3 if thermistor fails	If the thermistors fail open or short, error code appears before starting operation. If resistance values are just off, T-K3 will have temperature fluctuations in hot water.				
Error codes when thermistors fails.	**311 (Outlet)** **321 (Inlet)** **331 (Mixing)**				
Diagnostic	1. Visual inspection: connection/breakage of wires and/or debris on thermistor 2. Check voltages and resistance; proper range of values shown below.				
Color/Number of wires	Inlet Black(42)-Black Outlet Black(12)-Black Mixing Black(113)-Black	68˚F (20℃) 9.0~13KΩ 122˚F (50℃) 3.3~4.4KΩ 176˚F (80℃) 1.4~1.8KΩ (see table below for more resistance values)			



Resistance values of thermistors as a function of

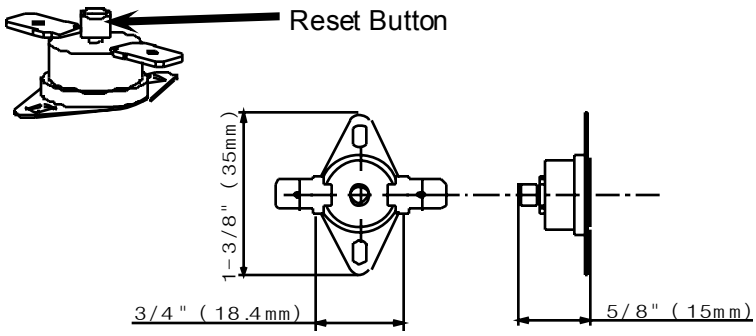


10-12. Hi-limit switch

T-K3 Part #	#409	Takagi Part #	EKN34	Checkpoint	C1
Function	-Based on bi-metal thermal expansion. -Detects excessively high water temperature (more than 194˚F or 90˚C) in pipes of the heat exchanger. -After detection, communication between the computer board and gas valves are severed, shutting down the T-K3 instantly. The "111" or "121" error codes will display.				
Failure event	1. Unable to detect excessively high water temperatures if switch fails "closed". 2. Continuous detection of excessively high water temperatures (regardless of what the actual water temperature is) if switch fails "open".				
Effects on the T-K3 if hi-limit switch fails.	1. Unable to shut down the T-K3 if the water temperature from the heat exchanger exceeds 194˚F (90˚C). Note: The mixing and outlet thermistors always act as backup hi-limit detectors to detect excessively high water temperatures in the heat exchanger. 2. The T-K3 is always shut down immediately after the ignition process, and either the "111" or "121" error code will display.				
Error codes when hi-limit switch fails.	**111** **121** **The T-K3 doesn't have the "141" error code that was used in our previous models. This error code is now replaced by the "111" and the "121" error codes.**				
Diagnostic	1. Visual inspection: connection/breakage of wires. Possibility also includes scale deposits inside the heat exchanger. 2. Check voltages and resistance: proper range of values shown below.				
Color/Number of wires	Blue-Blue Less than 1Ω				

When temperatures exceed 194˚F (90˚C), the reset button trips and switch goes to OFF mode.

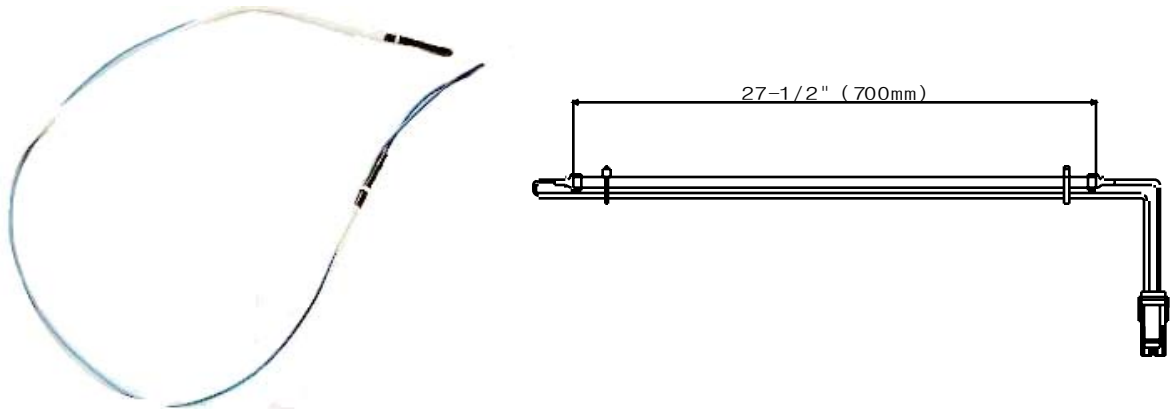
ON mode : <194˚F (90˚C) OFF mode : to reset switch back to ON mode, press the reset button



10-13. Overheat cutoff fuse

T-K3 Part #	#411	Takagi Part #	EKK0S	Checkpoint	C2
Function	-The overheat cutoff fuse contains solder with a melting point of 365°F (185°C). -Detects excessive temperatures within the T-K3, especially around the heat exchanger and combustion chamber. Upon detection, communication between the computer board and gas valves will sever, shutting down the T-K3 instantly. The "111" or "121" error code will display.				
Failure event	1. Unable to detect the excessively high temperatures within the T-K3.				
Effects on the T-K3 if the overheat cutoff fuse fails.	1. Flames from burner may penetrate a ruptured/damaged heat exchanger. 2. Gas valves will not operate.				
Error codes when the fuse fails.	**111** **121**				
Diagnostic	1. Visual inspection: connection/breakage of wires. 2. Check voltages and resistance: proper range of values shown below.				
Color/Number of wires	Blue-Blue Less than 1Ω				

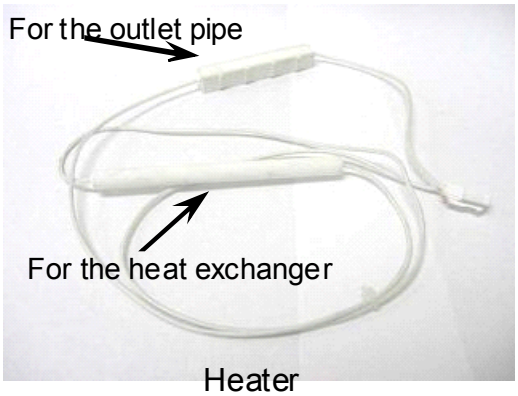
Solder will melt at temperatures exceeding 365°F (±9°F) or 185°C (±5°C)



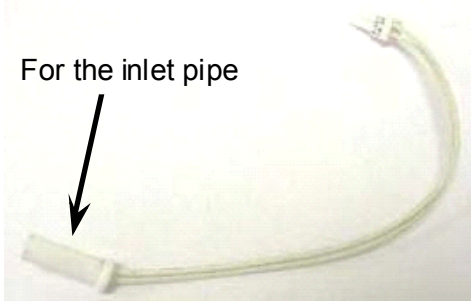
10-14. Freeze protection heaters

T-K3 Part #	#412 #418(Inlet)	Takagi Part #	EKK2R EKK2P(Inlet)	Checkpoint	B1
Function	Prevents the heat exchanger, water valves, and water pipes within the T-K3 from freezing. The heaters are but one of the freeze protection devices in the T-K3.				
Failure event	Open circuit failure : ceramic heaters do not receive the voltage needed to heat up.				
Effects on the T-K3 if heaters fail.	Ceramic heaters do not activate, allowing water contained in the heat exchanger to freeze up, possibly causing the heat exchanger to burst.				
Error codes when heaters fail.	**N/A**				
Diagnostic	1. Visual inspection: connection/breakage of wires and the condition of the heaters. 2. Check: whether those are in the normal range as shown in the following table.				
Color/Number of wires	White - White AC 90~110V (during operation)				

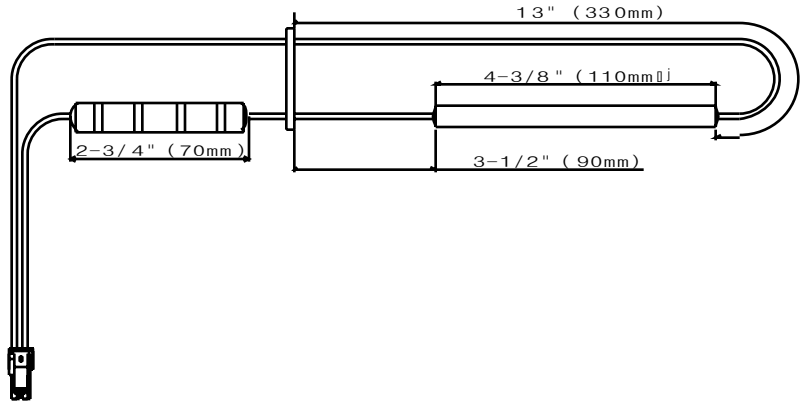
The T-K3 has two types of the heaters in it. The one is for protecting of the heat exchanger and the outlet pipe, the other one is for protecting of the inlet pipe.

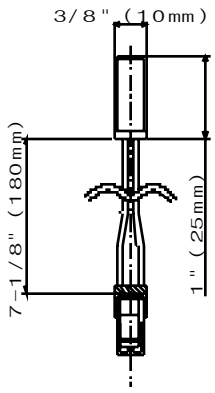


Heater



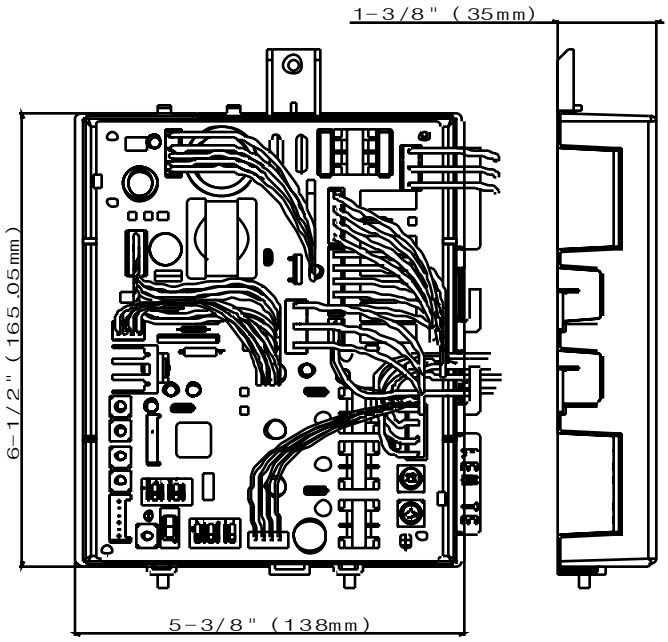
Inlet Heater





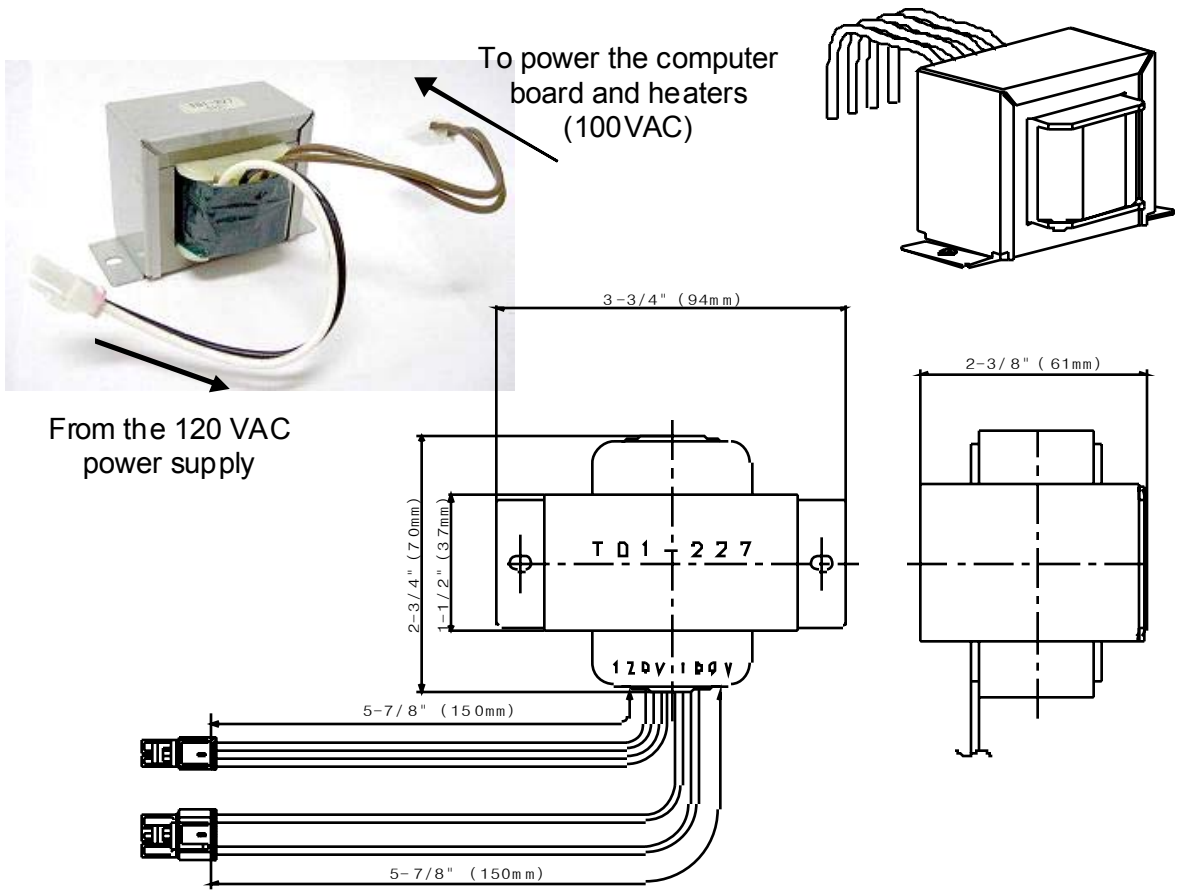
10-15. Computer board

T-K3 Part #	#701	Takagi Part #	EKK1L	Checkpoint	N/A
Function	Controls the functions of most of the parts in the T-K3.				
Failure event	Malfunctioning computer				
Effects on the T-K3 if the computer board fails.	-A component(s) may not operate within the T-K3. In most cases of computer board failure, the whole T-K3 does not operate at all. -Error codes display.				
Error codes when the computer board fails.	**701 721 741 991 761 (during multi-unit operation)**				
Diagnostic	Visual inspection: connection/breakage of wires and/or burn marks on the computer board.				
Color/Number of wires	**N/A**				



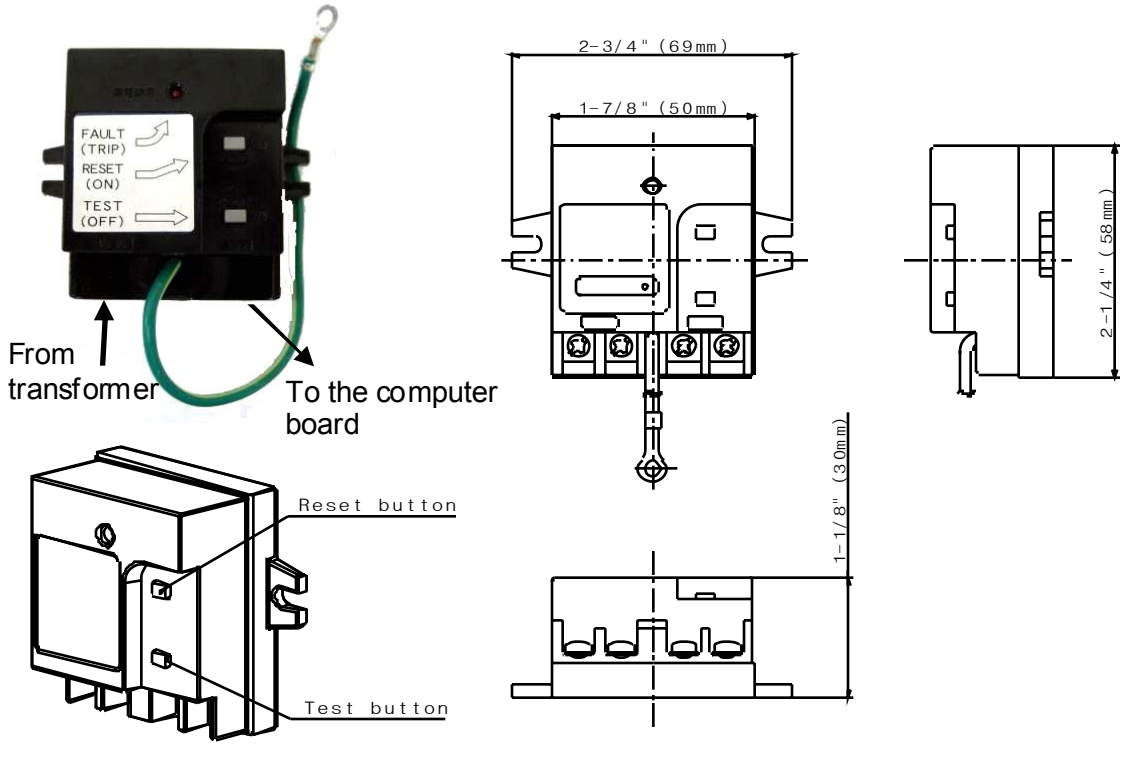
10-16. Transformer

T-K3 Part #	#702	Takagi Part #	EKH09	Checkpoint	A1, A2
Function	-To transform input voltage from 120VAC to 100VAC. -Every electrical component of the T-K3 is designed to only work with a 100VAC power supply, therefore, the T-K3 comes equipped with this transformer.				
Failure event	1. There is no power coming from the transformer. 2. The voltage from the power supply cannot be converted to 100VAC.				
Effects on the T-K3 if transformer fails	1. The T-K3 does not operate due to lack of power from transformer. 2. A failed transformer can cause electrical damage to other electrical components within the T-K3.				
Error codes when transformer.	**N/A**				
Diagnostic	1. Visual inspection: connection/breakage of wires and/or signs of electrical damage. 2. Check voltages of the transformer: Proper range of values shown below.				
Color/Number of wires	White -Black 120VAC / less than 1Ω				
	Brown-Brown 100VAC / less than 1Ω				



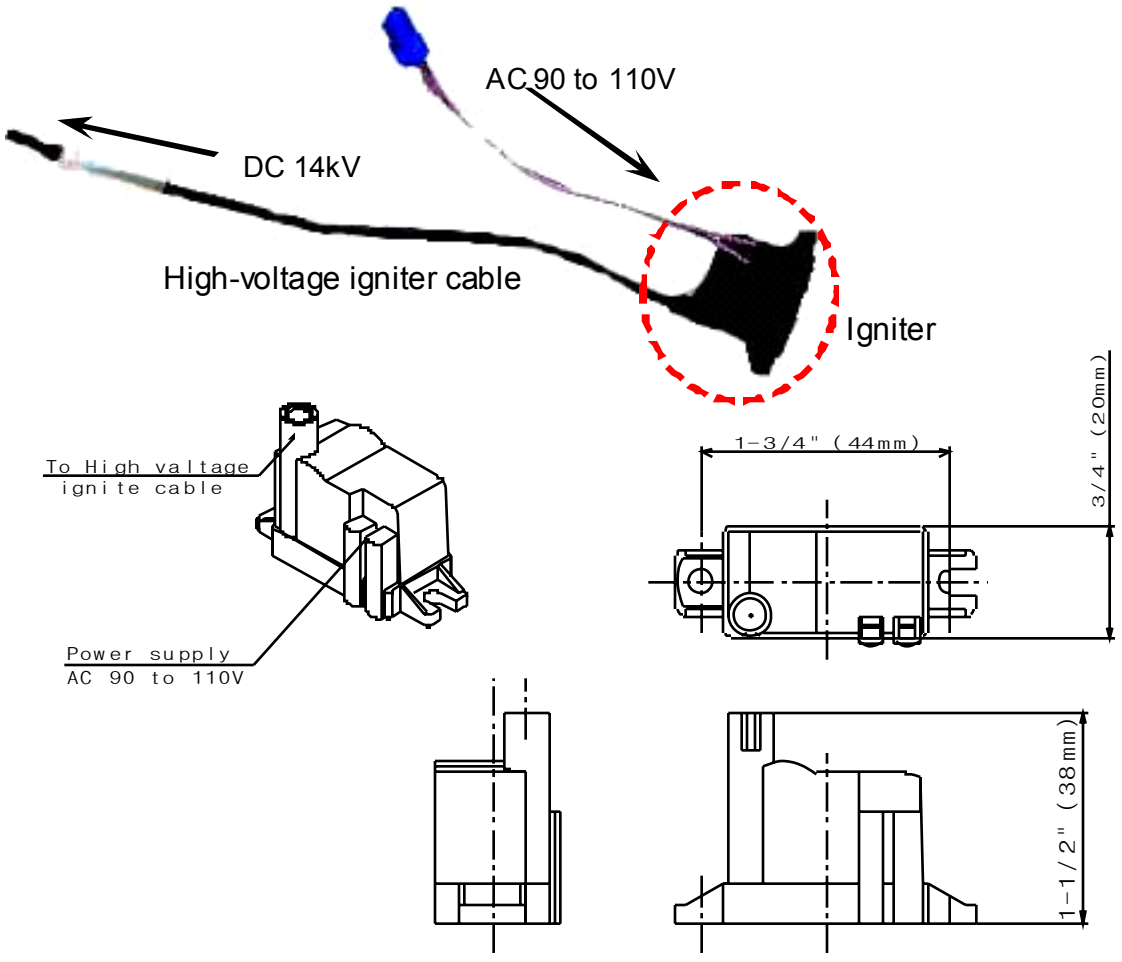
10-17. GFI

T-K3 Part #	#703	Takagi Part #	EKN73	Checkpoint	A, A1
Function	-Detects electrical leakage in the T-K3. -Stops providing power to the T-K3 in the case of electrical leakage.				
Failure event	1. ON-failure: Always in the ON mode (never trips). 2. OFF-failure: Always in the OFF mode (always stays tripped).				
Effects on the T-K3 if the GFI fails.	1. ON-failure: GFI cannot detect electrical leakage within the T-K3. 2. OFF-failure: the T-K3 does not receive any power from the GFI, which means the T-K3 cannot operate.				
Error codes when the GFI fails.	**N/A**				
Diagnostic	1. Visual inspection: connection/breakage of wires and/or some signs of electrical damage on the GFI 2. Check the power supply to the GFI. If the red LED on the GFI lights up after pressing the "test" button, the GFI is receiving power. After verifying the power supply, verify that 100VAC is entering and leaving the GFI.				
Color/Number of wires	**N/A**				



10-18. Igniter

T-K3 Part #	#704	Takagi Part #	EKN74	Checkpoint	B2
Function	-To ignite the gas/air mixtures when the T-K3 is ready to burn gas on its burner surface. -The output voltage of the igniter is more than 14kV.				
Failure event	1. Unable to ignite during the ignition process. 2. Makes attempts to ignite at all times.				
Effects on the T-K3 if the igniter fails	1. The T-K3 cannot ignite during the ignition process and the "111" or "121" error codes will display. 2. No effects on the T-K3, however, the durability of the igniter wears down.				
Error codes when Igniter fails.	**111**		**121**		
Diagnostic	1. Visual inspection: connection/breakage of wires and/or an observed weak spark. 2. Check voltages: proper range of values shown below.				
Color/Number of wires	Purple(7)-Purple(7) 90 VAC-110 VAC				

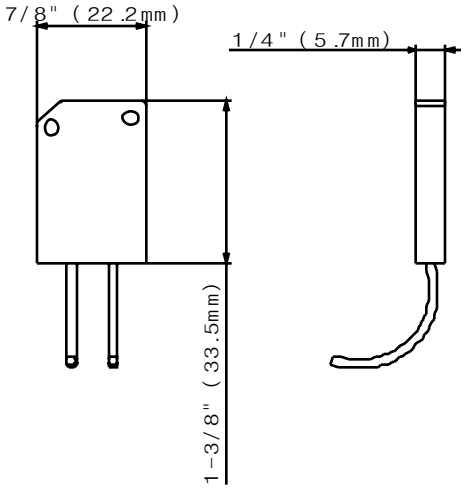


10-19. Freeze protection thermostat

T-K3 Part #	#705	Takagi Part #	EKJ59	Checkpoint	B1
Function	Temperature detecting device which prevents the pipes within the T-K3 from freezing. When this device detects temperatures below 36.5˚F (2.5˚C) inside the T-K3, power is supplied to the electric heaters to prevent the T-K3 from freezing.				
Failure event	1. ON-failure (Always senses freezing temperatures, regardless of actual temperature). 2. OFF-failure (Never senses freezing temperatures).				
Effects on the T-K3 if the freeze protection thermostat fails.	1. The freeze protection heaters will always be ON, causing heat damage to components inside the T-K3. 2. The freeze protection heaters will never be able to turn on, even under freezing temperatures, causing freeze damage to the T-K3.				
Error codes when the freeze protection thermostat fails.	**N/A**				
Diagnostic	1. Visual inspection: connection/breakage of wires and/or the body has been broken. 2. Check resistance and voltage: proper range of values shown below.				
Color/Number of wires	Black - Black (itself)	ON mode: 90 VAC - 110 VAC and less than 1Ω OFF mode: less than 1 VAC and more than 1MΩ			

Activation and deactivation temperatures of the T-K3's freeze protection system

ON mode: 36.5˚F (+6.3˚F -2.7˚F)	2.5˚C (+3.5˚C -1.0˚C)
OFF mode: above 46.4˚F	above 8˚C



11. Fault Analysis & Specifications

Remarks:

1 Proper range of values of voltage & resistance shown below.
2 Please refer to the wiring diagram for checkpoint positions.
3 Remove power to T-K3 when checking for continuity, disconnections, resistance value

Nature of Fault	Diagnosis	Checkpoint
・No display on temperature remote controller, even when remote is turned on.	1 Check the power supply ① Check the power supply from the GFI to the PCB **(Refer to section 12-2)** ② Check the power supply line to the T-K3	
	2 Fault of GFI Normal: AC100V between (white-black) Normal: AC100V between (brown-brown)	 A A1
	3 Fault of transformer ① Disconnection / breakage of wires Normal: AC120V between (white-black) Normal: AC100V between (brown-brown)	 A2 A1
	4 Blown fuse at PCB (3A)	A2
	5 Fault of PCB ① No voltage at remote control terminal Normal: 11VDC - 25VDC between (white-black)	 F
	6 Disconnection/short-circuit/grounding of remote wires Normal: 11VDC - 25VDC between (white-black)	
	7 Fault of PCB of remote control ① Check for normal voltage at terminal	
・It takes long time to get hot water at the fixtures	1 The time it takes to deliver hot water from the T-K3 to your fixtures depend on the length of piping between them. The longer the distance and/or the bigger the pipes, the longer it will take to get hot water.	
・The water is not hot enough	1 Check cross plumbing between cold water lines and hot water lines. 2 Check whether the gas supply pressure is enough. 3 Check whether the temperature setting is too low.	
・The water is too hot	1 Check whether the temperature setting is too high.	
・The hot water is not available when a fixture is opened	1 Make sure the unit gets a 120V 60Hz power supply. 2 If the remote controller is used, check whether the power button is turned on. 3 Check that the filter on the cold water inlet is clean. 4 Check whether the hot water fixture is sufficiently open to draw at least 0.5 GPM through the water heater. 5 Check that the filter on the cold water inlet is clean. 6 Check whether or not the unit is frozen. 7 Check if there is enough gas in the tank. (for propane units)	

Nature of Fault	Diagnosis	Checkpoint
·The hot water turns cold and stays cold	1 Check whether the flow rate enough to keep the T-K3 running. 2 Check if there is a recirculation system installed and check also if the recirculation line has enough check valves. 3 Check that the filter on the cold water inlet is clean. 4 Check that the fixtures are free from debris and obstructions.	
·The fan motor is still spinning after operation has stopped	1 This is normal. After operation has stopped, the fan motor keeps its running from 5 to 50 sec. in order to re-ignite quickly, as well as purge all the exhaust gas out of the flue.	
·Abnormal sounds come from the unit	1 Check if there is any blockage on the air inlet of the unit. 2 Check if there is any blockage of the exhaust pipe. 3 Check the manifold pressure in the unit.	

Nature of Fault	Malfunction description	Cancellation method
·Fluctuation of hot water temperature.	-Fault of gas solenoid valves (SV_3 & SV_2) during stage changes -Fault of flow adjustment valve	

Diagnosis	Checkpoint
1 Check whether the filter in cold water inlet is cleaned. 2 Check whether the gas supply pressure is adequate. 3 Check for cross connections between cold water lines and hot water lines.	
4 Fault of PCB in the T-K3. ① No voltage to gas solenoid valve (SV_2). Normal: DC78～100V between COM (blue) & #53 (orange) ② No voltage to gas solenoid valve (SV_3). Normal: DC78～100V between COM (blue) & #73 (red)	C
5 Gas solenoid valve (SV_2) fault ① Disconnected wiring to gas solenoid valve (SV_2) Normal: 1.3～1.9kΩ between COM (blue) & #53 (orange) ② Disconnected wiring to gas solenoid valve (SV_3) Normal: 0.9～1.7kΩ between COM (blue) & #73 (red)	C
6 PCB fault ① No voltage to flow adjustment valve Normal: DC7～16V between (red-black)	J1
7 Flow adjustment valve fault Normal: 0.09～0.2kΩ between (red-black)	J1

Error Code	Malfunction description	Cancellation method
031	Dipswitch setting fault	Turn off the power or water supply
	Diagnosis	**Checkpoint**
	Check the dipswitch settings on PCB	

Error Code	Malfunction description	Cancellation method
101	Warning for the "991" error code **(Refer to section 12-3)**	On the PCB, press the INC and DEC buttons simultaneously for 3 sec. Then turn the power off.
	Diagnosis	**Checkpoint**
	1 Check if there is any blockage in the air inlet of the unit. 2 Check if there is any blockage along the exhaust run. 3 Check the manifold pressure in the T-K3.	

Error Code	Malfunction description	Cancellation method
111	Ignition failure	Turn off the power or water supply
Error code is shown after three failed attempts at ignition	**Diagnosis**	**Checkpoint**
	1 Check gas supply and pressure **(Refer to section 1)**	
	2 Check the igniter **(Refer to section 10-18)** Visual inspection: connection/breakage of wires and/or observed weak spark. ① Cracks/soot on igniter rod ② Improper gap between burner & igniter rod Normal gap: 0.16" ③ PCB fault Normal: AC 90～110V at #7 (purple-purple) ④ Igniter fault	B2
	3 PCB fault ① No voltage to main gas solenoid valve (MV) Normal: DC78～100V between COM (blue) & #3 (light blue) ② No voltage to gas solenoid valve (SV_1) Normal: DC78～100V between COM (blue) & #9 (green) ③ No voltage to gas proportional valve (VG_0) Normal: DC1～15V between white & red	C H1
	4 Gas solenoid valve fault ① Main gas solenoid valve (MV) fault Normal: 0.9～1.3kΩ between COM (blue) & #3 (light blue) ② Gas solenoid valve (SV_1) fault Normal: 1.3～1.9kΩ between COM (blue) & #9 (green) ③ Gas proportional valve (VG_0) fault Normal: DC1～15V between white & red	C H1
	5 Disconnected/damaged O.H.C.F. **(Refer to section 10-13)** Visual inspection:connection/breakage of wires. Normal: 1Ω or less between blue & blue	C2

Error Code	Diagnosis	Checkpoint
111 Error code is shown after three failed attempts at ignition	6 Disconnected/damaged hi-limit switch. **(Refer to section 10-12)** Visual inspection: connection/breakage of wires. Normal:1Ω or less between blue & blue	C1
	7 Inspect flame rod ① Check for any soot on the rod. ② Check the connection of ground wire; make sure there is firm contact to the ground of the T-K3 (in this case, the wire is contacted to the manifold surface.) ③ PCB fault During operation: more than 1μA through the flame rod wire (orange) ④ Flame rod fault (insulated resistance) Normal: 40KHz~60KHz (between orange & green)	I
	8 Check if hi-limit switch is properly functioning.	

Error Code	Malfunction description	Cancellation method
121	Flame blows out	Turn off the power or water supply
	Diagnosis	**Checkpoint**
Error code is shown after three failed attempts at ignition	1 Check gas supply and pressure **(Refer to section 1)**	
	2 PCB fault ① No voltage to gas main solenoid valve (MV) Normal: DC78~100V between COM (blue) & #3 (light blue) ② No voltage to gas solenoid valve (SV_1) Normal: DC78~100V between COM (blue) & #9 (green) ③ No voltage to gas proportional valve (VG_0) Normal: DC1~15V between white & red	C H1
	3 Gas solenoid fault ① Main gas solenoid valve (MV) fault Normal: 0.9~1.3kΩ between COM (blue) & #3 (light blue) ② Gas solenoid valve (SV_1) fault Normal: 0.9~1.9kΩ between COM (blue) & #9 (green) ③ Gas proportional valve (VG_0) fault Normal: DC1~15V between white & red	C H1
	4 Check for soot on the flame rod ① Clean the flame rod ② PCB fault During operation: more than 1μA through the flame rod wire (orange) ③ Flame rod fault (insulated resistance) Normal: 40KHz~60KHz (orange & green)	I

Error Code	Malfunction description	Cancellation method
121 Error code is shown after three failed attempts at ignition	5 Disconnected/damaged O.H.C.F. **(Refer to section 10-13)** Visual inspection:connection/breakage of wires. Normal: 1Ω or less between blue & blue	C2
	6 Check if hi-limit switch is properly functioning.	
	7 Disconnected/damaged hi-limit switch. **(Refer to section 10-12)** Visual inspection: connection/breakage of wires. Normal: 1Ω or less between blue & blue	C1

Error Code	Malfunction description	Cancellation method
311	Disconnected/short-circuited outlet thermistor	Turn off the power or water supply
	Diagnosis	**Checkpoint**
	1 Outlet thermistor fault **(Refer to section 10-11)** Visual inspection: connection/breakage of wires and/or debris on thermistor. Check voltage/resistance between black & black (#12). Refer to Section 8 for proper range of values.	E2

Error Code	Malfunction description	Cancellation method
321	Disconnected/short-circuited inlet thermistor	Turn off the power or water supply
	Diagnosis	**Checkpoint**
	1 Inlet thermistor fault **(Refer to section 10-11)** Visual inspection: connection/breakage of wires and/or debris on thermistor. Check voltage/resistance between black & black (#42). Refer to Section 8 for proper range of values.	E3

Error Code	Malfunction description	Cancellation method
331	Disconnected/short-circuited mixing thermistor	Turn off the power or water supply
	Diagnosis	**Checkpoint**
	1 Mixing thermistor fault **(Refer to section 10-11)** Visual inspection: connection/breakage of wires and/or debris on thermistor. Check voltage/resistance between black & black (#113). Refer to Section 8 for proper range of values.	E1

Error Code	Malfunction description	Cancellation method
391	Disconnected AFR rod	Turn off the power or water supply
	Diagnosis	**Checkpoint**
	1 AFR rod fault **(Refer to section 10-6)** Visual inspection:connection/breakage of wires and/or soot buildup.	I

Error Code	Malfunction description	Cancellation method
441	Flow sensor failure	Turn off the power or water supply
	Diagnosis	**Checkpoint**
	1 Flow sensor fault **(Refer to section 10-9)** Visual inspection: connection/breakage of wires and/or debris on impeller. Check voltage/resistance between (red & black) or (white & black)	H2

Error Code	Malfunction description	Cancellation method
510	Fault of driving circuit for any of the gas solenoid valves (MV, SV_1, SV_2, and/or SV_3) (The computer checks the condition of the main gas valve immediately after every operation and the conditions of the solenoid valves 6 hours after every operation)	Turn off the power supply
	Diagnosis	**Checkpoint**
	1 PCB and/or gas valve fault **(Refer to section 10-4 & 10-15)** Visual inspection of gas valves: connection/breakage of wires. Normal: DC78～100V between COM (blue) & #3 (light blue) Normal: DC78～100V between COM (blue) & #9 (green) Normal: DC78～100V between COM (blue) & #53 (orange) Normal: DC78～100V between COM (blue) & #73 (red) Visual inspection of PCB: connection/breakage of wires and/or burn marks on the computer board. 2 Gas solenoid valve fault (MV, SV_1, SV_2, and/or SV_3)	C

Error Code	Malfunction description	Cancellation method
611	Fan motor fault	Turn off the power or water supply
	Diagnosis	**Checkpoint**
	1 PCB and fan motor fault **(Refer to section 10-3 & 10-15)** Visual inspection of fan motor: connection/breakage of wires or dust buildup (causing electrical shortage) Normal: DC 110～160V between red & blue Normal: DC 13～17V between yellow & blue Normal: DC 2.0～6.5V between orange & blue Verify fan motor speed of the T-K3 using the "diagnostics mode" of the TM-RE10 temperature remote controller. See the "12-1. How to diagnose the T-K3 using the TM-RE10" Visual inspection of PCB: connection/breakage of wires and/or burn marks on the computer board.	G

Error Code	Malfunction description	Cancellation method
651	Flow adjustment valve fault	Turn off the power or water supply

Diagnosis	Checkpoint
1 PCB and flow adjustment valve fault. **(Refer to section 10-8 & 10-15)** Visual inspection of flow adjustment valve: connection/breakage of wires, motor drive locked due to scale buildup, and/or water leakage. Normal: DC 7~16V between (black-red) Visual inspection PCB: connection/breakage of wires and/or burn marks on the computer board.	J1

Error Code	Malfunction description	Cancellation method
701	1 PCB fault ① Fault of preparation for the outlet thermistor operation. ② Fault of driving circuit for Gas Proportional Valve(VG_0)	Turn off the power or water supply

Diagnosis	Checkpoint
1 Check the PCB **(Refer to section 10-15)** Visual inspection: connection/breakage of wires and/or burn marks on the computer board.	

Error Code	Malfunction description	Cancellation method
721	False flame detection	Turn off the power or water supply

Diagnosis	Checkpoint
1 False flame detection (5 sec.) Flame rod (insulated resistance) fault	I

Error Code	Malfunction description	Cancellation method
741	Miscommunication between T-K3 and temperature remote controller	Restoring proper cable connections between the T-K3 and the Remote controller (TM-RE10 or TM-RE30). When the computer detects proper connections between the the T-K3 and the remote controller, "741" error code will cease to display.

Diagnosis	Checkpoint
1 Temperature remote controller (TM-RE10 / TM-RE30) or PCB fault 2 Check for signs of power surges.	

Error Code	Malfunction description	Cancellation method
761	Miscommunication between Master and Slave units for Easy-Link systems.	Restoring proper cable connections among all the T-K3s. When the computer detects proper connections among all the T-K3s, "761" error code will cease to display.
	Diagnosis	**Checkpoint**
	1 Inspect cable connections between Master and Slave units. 2 Check for signs of power surges.	

Error Code	Malfunction description	Cancellation method
991	Abnormal burning **(Refer to section 12-3)**	Turn off the power or water supply If not possible, press and hold the INC and DEC buttons on the computer board simultaneously for more than 3 sec.
	Diagnosis	**Checkpoint**
	1 Check for blockage on the air inlet of the T-K3. 2 Check for blockage of the exhaust run. 3 Check for proper manifold pressure in the T-K3. 4 Consider altitude/elevation of region of where the T-K3 installed.	

12. Controls and settings

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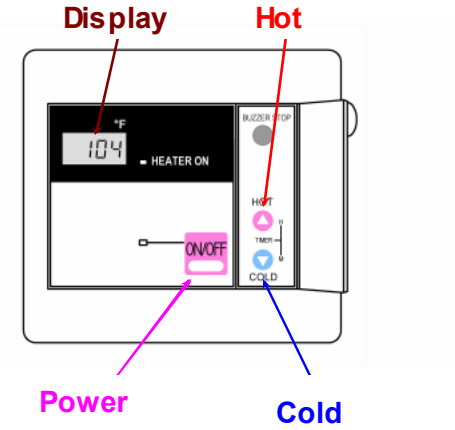
12-1. (A) Diagnosing the T-K3 using the TM-RE10

<For a single T-K3>

1. Press and hold the "HOT" and "COLD" buttons simultaneously for at least 5 seconds to enter "Diagnostics Mode".
2. Number "0" will be displayed. (Fig.1)
3. Scroll through the mode #'s by pressing the "HOT" or "COLD" buttons to scroll up or down. (Fig.2)
4. Once desired mode # is displayed, press the white button located under the "Buzzer Stop" button to select the mode. The information for that mode will be displayed. (Fig.3)
5. If 5 minutes have elapsed without pressing any buttons, the display will return to normal.



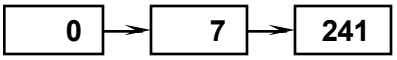


Fig.1 Fig.2 Fig.3

For example, mode #7 will display the value of the electrical current of the AFR rod.

<For multiple T-K3's in an Easy-Link multi-unit system>

1. Press and hold the "HOT" and "COLD" buttons simultaneously for at least 5 seconds to enter "Diagnostics Mode".
2. Number "0" will be displayed. (Fig.1)
3. Scroll to the desired T-K3 unit # (either 1, 2, 3, or 4) by pressing the "HOT" or "COLD" buttons to scroll up or down. #0 will yield information on the whole multi-unit system. (Fig.2)
4. Once desired # is displayed, press the white button located under the "Buzzer Stop" button to select the # (either a particular T-K3 unit or the whole multi-unit system). The number "1" will then display right next to that selected #. (Fig.3)
5. Scroll through the mode #'s by pressing the "HOT" or "COLD" buttons. (Fig.4)
6. Once desired mode # is displayed, press the white button located under the "Buzzer Stop" button to select the mode. The information for that mode will be displayed. (Fig.5)
7. If 5 minutes have elapsed without pressing any buttons, the display will return to normal.

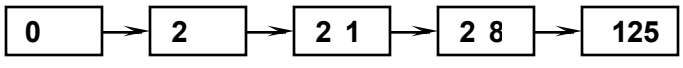


Fig.1 Fig.2 Fig.3 Fig.4 Fig.5

For example, this sequence will display the flow rate information of the second T-K3 unit.

12-1. (B) Diagnosing the T-K3 using the TM-RE30

< For a single T-K3 >

1. Press the "**HOT**" button and the "**COLD**" button simultaneously for at least 5 seconds to enter "Diagnostic mode".
2. Scroll up or down to the needed information (mode #) of the T-K3 by pressing the "**HOT**" or "**COLD**" buttons (Fig.1 shows mode #5 being selected.)
   When selecting information, please refer to the table on p. 44 for the proper mode #.
3. Press the "**INFO**" button to select the mode #, and the information to which the mode # correlates to will display on the TM-RE30 (Fig.2).
4. When the "ON/OFF" button is pressed or 5 minutes have elapsed without pressing any buttons, the display will return to normal.

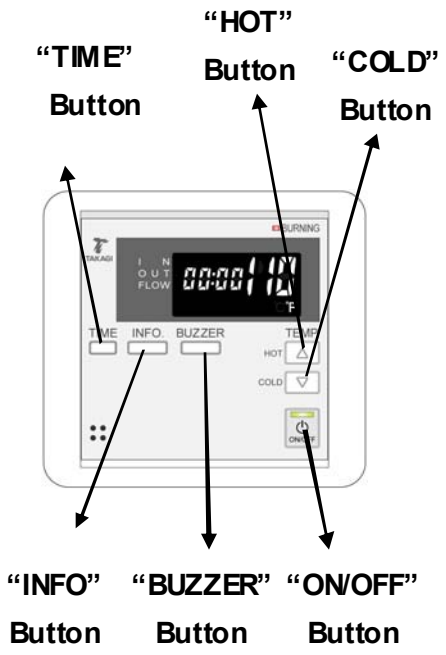


Fig.1

Fig.2

< For multiple T-K3's in an Easy-Link multi-unit system >

1. Press and hold the "**HOT**" and "**COLD**" buttons simultaneously for at least 5 seconds to enter "Diagnostics Mode".
2. "0" will be displayed on the TM-RE30. (See Fig. 1)
3. Scroll to the desired T-K3 unit # in the easy-link system by pressing the "**HOT**" or the "**COLD**" buttons to scroll up or down. (Fig. 2 shows that unit #2 is being selecting)

NOTE: The definition of the unit #'s:

"0" will yield information about the Easy-link system as a whole, and numbers "1", "2", "3", & "4" will yield information about each of the individual T-K3's installed in the Easy-link system.

In an Easy-link system of T-K3's, a maximum of 4 T-K3's can be linked together.

4. Press the "**INFO**" button to select the desired unit #.
5. When the desired unit # is selected and fixed, scroll up or down to the needed information (mode #) of the unit by pressing the "**HOT**" or "**COLD**" buttons.
   (Fig.3 shows mode #6 is being selected.) **When selecting information, please refer to the table on the next page for the proper mode #.**
6. Press the "**INFO**" button to select the mode #, and information to which the mode # correlates to will display on the TM-RE30. (Fig. 4)
7. When the "**ON/OFF**" button is pressed or 5 minutes have elapsed without pressing any buttons, the display will return to normal.

Fig.1

Fig.2

Fig.3

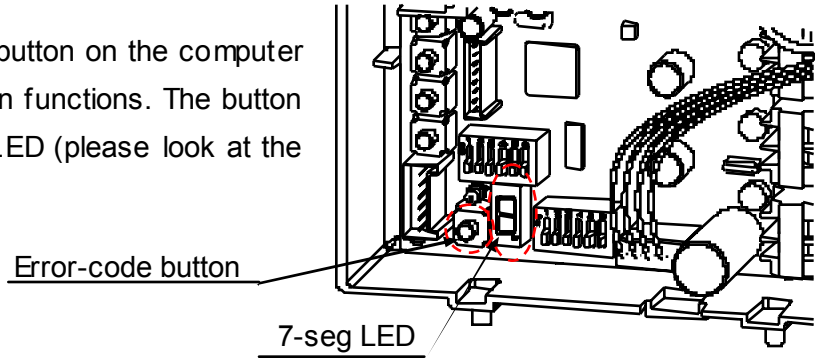
Fig.4

Description of mode numbers in “Diagnostics Mode”

Mode #	Whole multi-unit system information (#0)		Individual T-K3 unit information (#1 to #4)	
1	Total system flow rate	0 - 999 (× 0.1 GPM)	Total operation time	0 to 9999 (hours)
2	ON/OFF cycles	0 to 9999 (× 100 cycles)	ON/OFF cycles	0 to 9999 (× 100 cycles)
3	Quantity of connected T-K3's	2 - 4 (units)	Fan motor speed	0 to 9999 (rpm)
4	Priority T-K3 unit	1 - 4 (unit #)	Inlet temperature	32 to 210 (ºF). Over 210ºF=E5, under 32ºF=E0
5	Quantity of operational T-K3's	1 - 4 (units)	Outlet temperature	32 to 210 (ºF) over 210ºF=E5, under 32ºF=E0
6	Output set temperature	99 to 185 ºF	Mixing temperature	32 to 210 (ºF) over 210ºF=E5, under 32ºF=E0
7	Operation time during current rotation	0 to 720 (minutes). After 720, the next rotation occurs	Air-Fuel ratio rod current	0 to 999 (× 0.1 μA)
8	ON/OFF cycles during current rotation	0 to 100 (cycles). After 100, the next rotation occurs	Flow rate	0 to 999 (× 0.1 GPM)
9	N / A		Bypass valve position	0 to 999, fully closed position=0
A	N / A		Ratio of hot water and cold water	0 to 999 (× 0.1%)
B	N / A		Error code history: displays most recent error code	
C	N / A		Error code history: displays 2nd most recent error code	
D	N / A		Error code history: displays 3rd most recent error code	
E	N / A		Clears memory in error code history	
F	N / A		N / A	
0	N / A		Air-Fuel ratio stage	0 to 15, normal condition=6

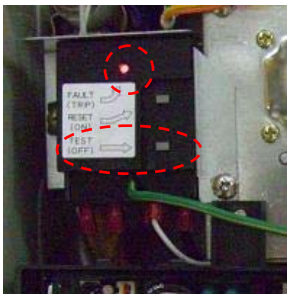
12-2. The error-code button: Verifying functionality of computer board, Displaying error code history, and Clearing error code history memory

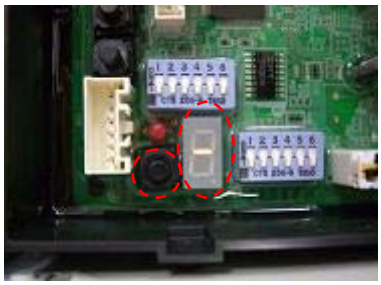
The T-K3 has as error-code button on the computer board that provides three main functions. The button is located next to the 7-seg LED (please look at the picture to the right).



A. Verifying functionality of computer board

1. Check the power supply to the GFI
   (If the red light turns on after pressing the "test" button on the GFI, the GFI is receiving power. After verifying power, press the "reset" button to turn off the light.)
2. Briefly press the error-code button (do not hold down the button).
3. If the computer board works properly, the 7-seg LED shows the most recent error code in its error code history (or a bar "—" if there are no error codes saved to memory), as shown in the picture to the right.



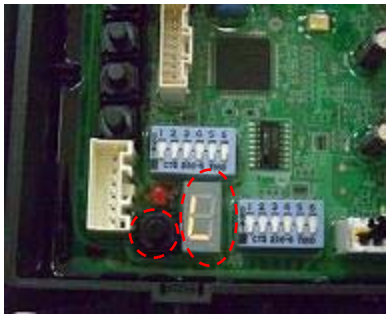


B. Displaying error code history

1. Briefly press the error-code button (do not hold down the button).
2. If the T-K3 has had prior error codes, the 7-seg LED will display the most recent error code first. Pressing the button again will display the 2nd most recent error code and so on (Computer saves a maximum of 10 error codes). If the T-K3 has never had any error codes, the 7-seg LED will display a bar "—".

C. Clearing error code history memory

1. Press and hold the error-code button for at least 5 seconds.
2. The 7-seg LED will display "C", "L" and "r" in succession to signify that the computer board memory has been erased of all error codes.



12-3. Clearing the "991" error code

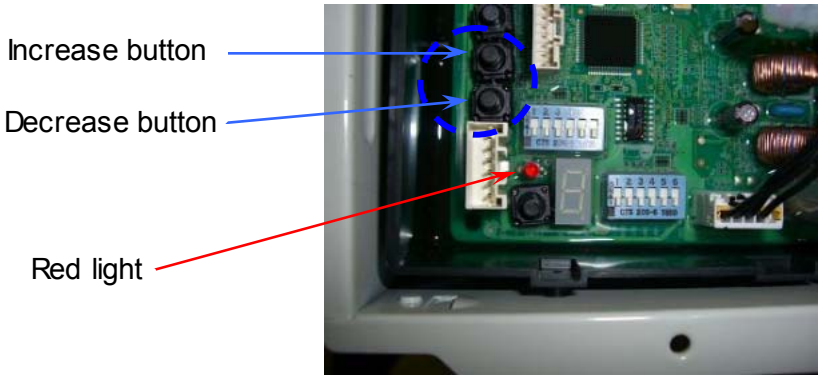
The T-K3's "991" error code signifies imperfect (abnormal) combustion, caused by insufficient intake air and/or obstructions in the exhaust.

A. **If the "991" error code occurs, please check the following:**

1. What is the T-K3's gas-type: liquid propane or natural gas?
2. How long has the T-K3 been installed and been in use?
3. Where is the T-K3 installed: indoor, outdoor, attic, etc?
4. What is the altitude/elevation of the area of installation?
5. If installed indoors, how long is the vent length?
6. If installed outdoors, what type of vent cap is used?
7. Are there any obstructions in the intake air and/or exhaust?

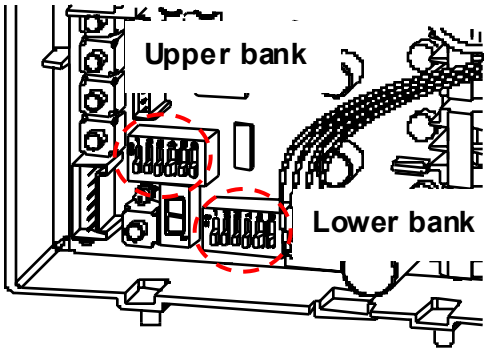
B. How to clear the "991" error code (after resolving the main root cause of the error):

On the computer board, press and hold the INCREASE and DECREASE buttons simultaneously for at least 3 seconds until the red light turns on. Then press reset button on the GFI. The "991" error code should then be cleared.



Press and hold the "INC" and "DEC" buttons simultaneously for at least 3 seconds.

12-4. Dipswitch settings

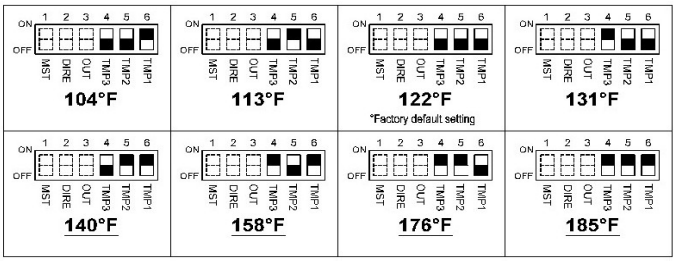


There are two banks of dipswitches (upper and lower bank) on the T-K3 computer board. The upper bank has certain special functions as shown on the following table and generally should not need adjustment. Carefully verify the functions of each dipswitch before changing any settings.

The functions of the upper bank of dipswitches

No.	Functions	ON position	OFF position
1	Gas type	Propane	Natural gas
2	Allow adjustments of fan motor speed (Changing the FM speed is similar to changing the manifold pressure.)	Enable	Disable (Default)
3	Changing the T-K3's ON/OFF mode (See Section 12-6 for details)	Continuous mode	Intermittent mode (Default)
4	FM+ (FM speed is increased automatically by 6%)	+6% fan motor speed	Disable (Default)
5	Deactivation of the freeze protection firing system	Enable	Disable (Default)
6	Freeze protection mode using circulation pump (for T-K3's installed in recirculation systems)	Enable	Disable (Default)

The functions of the lower bank of dipswitches

No.	Functions	ON position	OFF position
1	Master/Slave setting for Easy-Link systems	Master	Slave (Default)
2	Direct vent setting	Enable Direct vent mode	Disable (Default)
3	Outdoor setting	Enable Outdoor mode	Disable (Default)
4 5 6	Output temperature settings (See table to the right) (Default 122°F)		

12-5. Assigning unit numbers in the Easy-link system

- Each T-K3 in an Easy-link system is assigned a random unit #, except for the Master unit, which is always assigned as unit #1. This is why the T-K3's will not necessarily be numbered in order from left to right or right to left.
- When more than 4 T-K3s are connected in an Easy-link system, only the first 4 T-K3s will work as a system. The remaining T-K3(s) will not operate.

A. How to display the unit number

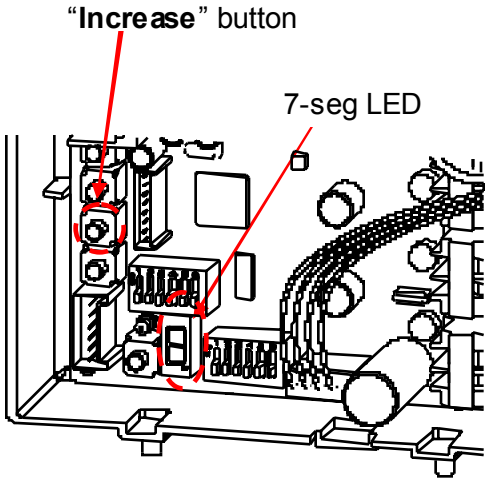
Press the "**Increase**" button on the computer board. The 7-seg LED will then display the assigned number for that T-K3 unit for 10 sec.

NOTE: In a single-unit installation, the numbering system is disabled.

B. How to reset and reconfigure the numbering of units

Unit #'s can be reset and reassigned manually:

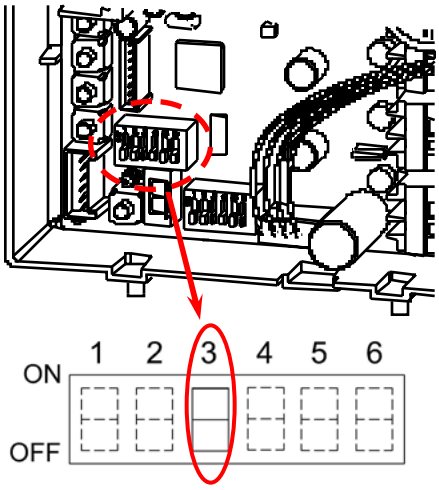
1. Press and hold the "**Increase**" button on the computer board of all slave units for at least 5 seconds.
2. The 7-seg LED on the computer board of all slave units will display "0" to signify that the computer memory has been erased of its previously assigned unit #.
3. Press and hold the "**Increase**" button again. New unit # will be assigned in order as you proceed through every unit



T-K3 Computer board

12-6. T-K3 ON/OFF conditions: Overview

The T-K3 has two modes of ON/OFF conditions. Select either mode by changing Dipswitch 3 on the upper bank of dipswitches as shown in the picture to the right.



Intermittent mode

This mode is the normal, default mode.

Continuous mode

This mode is for heating systems that deal with smaller temperature differentials.

ON/OFF Conditions	Intermittent mode (Default setting) <Dipswitch set to OFF>	Continuous mode <Dipswitch set to ON>
Conditions needed to turn the T-K3 ON.	The BTU requirement is more than 14,880 BTU/h AND The water flow rate is more than 0.52 GPM	The BTU requirement is more than 11,900 BTU/h AND The water flow rate is more than 0.52 GPM
Conditions needed to turn the T-K3 OFF	The BTU requirement is less than 11,900 BTU/h OR Inlet temperature is higher than the set temperature OR Outlet temperature is over 194°F OR The water flow rate is less than 0.4 GPM	The BTU requirement is less than 7,440 BTU/h OR Inlet temperature is higher than the set temperature OR Outlet temperature is over 194°F OR The water flow rate is less than 0.4 GPM

12-7. T-K3 ON/OFF conditions: BTU requirements for Intermittent mode

A. Calculating the T-K3's ON/OFF conditions

【Condition needed to turn the T-K3 ON】

$(T_{set} – T_{in}) \times GPM \times 500 > 14,880$

【Condition needed to turn the T-K3 OFF】

$(T_{set} – T_{in}) \times GPM \times 500 < 11,900$ or $T_{in} = T_{set}$

Where: T_{set} = Output set temperature and T_{in} = Inlet temperature

B. Calculation example

Set temperature: $T_{set} = 122^{\circ}F$ Flow rate = 2.5 GPM

【Condition needed to turn the T-K3 ON】

$(122 – T_{in}) \times 2.5 \times 500 > 14,880$ $T_{in} < 110.1^{\circ}F$

【Condition needed to turn the T-K3 OFF】

$(122 - T_{in}) \times 2.5 \times 500 < 11,900$ $T_{in} > 112.5^{\circ}F$

The outlet temperature at that moment will be 120°F

C. ON/OFF table

Set temperature (°F)		Flow rate (GPM)						
		1.0	1.5	2.0	2.5	3.0	3.5	4.0
113	ON	83.2	93.2	98.1	101.1	103.1	104.5	105.6
	OFF	89.2	97.1	101.1	103.5	105.1	106.2	107.0
122	ON	92.2	102.2	107.1	110.1	112.1	113.5	114.6
	OFF	98.2	106.1	110.1	112.5	114.1	115.2	116.0
131	ON	101.2	111.2	116.1	119.1	121.1	122.5	123.6
	OFF	107.2	115.1	119.1	121.5	123.1	124.2	125.0
140	ON	110.2	120.2	125.1	128.1	130.1	131.5	132.6
	OFF	116.2	124.1	128.1	130.5	132.1	133.2	134.0
158	ON	128.2	138.2	143.1	146.1	148.1	149.5	150.6
	OFF	134.2	142.1	146.1	148.5	150.1	151.2	152.0
167	ON	137.2	147.2	152.1	155.1	157.1	158.5	159.6
	OFF	143.2	151.1	155.1	157.5	159.1	160.2	161.0
185	ON	155.2	165.2	170.1	173.1	175.1	176.5	177.6
	OFF	161.2	169.1	173.1	175.5	177.1	178.2	179.0

12-8. T-K3 ON/OFF conditions: BTU requirements for Continuous mode

A. Calculating the T-K3's ON/OFF conditions

【Condition needed to turn the T-K3 ON】

$(T_{set} - T_{in}) \times GPM \times 500 > 11,900$

【Condition needed to turn the T-K3 OFF】

$(T_{set} - T_{in}) \times GPM \times 500 < 7,440$ or $T_{in} = T_{set}$

Where: T_{set} = Output set temperature and T_{in} = Inlet temperature

B. Calculation example

Set temperature: $T_{set} = 122\ ^{\circ}F$ Flow rate = 2.5 GPM

【Condition needed to turn the T-K3 ON】

$(122 - T_{in}) \times 2.5 \times 500 > 11,900$ $T_{in} < 112.5^{\circ}F$

【Condition needed to turn the T-K3 OFF】

$(122 - T_{in}) \times 2.5 \times 500 < 7,440$ $T_{in} > 116.0\ ^{\circ}F$

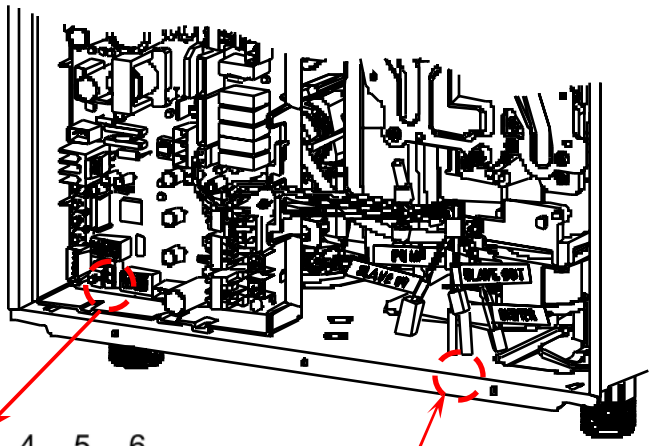
The outlet temperature at that moment will be 120 °F

C. ON/OFF table

set temperature (°F)		Flow rate (GPM)						
		1.0	1.5	2.0	2.5	3.0	3.5	4.0
113	ON	89.2	97.1	101.1	103.5	105.1	106.2	107.1
	OFF	98.1	103.1	105.6	107.0	108.0	108.7	109.3
122	ON	98.2	106.1	110.1	112.5	114.1	115.2	116.1
	OFF	107.1	112.1	114.6	116.0	117.0	117.7	118.3
131	ON	107.2	115.1	119.1	121.5	123.1	124.2	125.1
	OFF	116.1	121.1	123.6	125.0	126.0	126.7	127.3
140	ON	116.2	124.1	128.1	130.5	132.1	133.2	134.1
	OFF	125.1	130.1	132.6	134.0	135.0	135.7	136.3
158	ON	134.2	142.1	146.1	148.5	150.1	151.2	152.1
	OFF	143.1	148.1	150.6	152.0	153.0	153.7	154.3
167	ON	143.2	151.1	155.1	157.5	159.1	160.2	161.1
	OFF	152.1	157.1	159.6	161.0	162.0	162.7	163.3
185	ON	161.2	169.1	173.1	175.5	177.1	178.2	179.1
	OFF	170.1	175.1	177.6	179.0	180.0	180.7	181.3

12-9. Pump control ON/OFF conditions: Overview

Dipswitch 3 on the upper bank of dipswitches (shown in the picture to the right) also sets the mode for the pump control ON/OFF conditions. Again, there are two modes of ON/OFF conditions for the pump control.



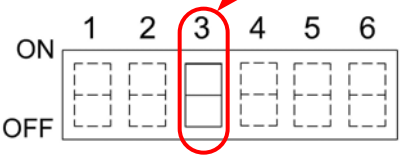
Intermittent mode

This mode is the normal, default mode.

Continuous mode

This mode is for heating systems that require pumps to continuously run.

Dipswitch settings for the ON/OFF conditions of the pump control



Pump connectors

ON/OFF Conditions	Intermittent mode (Default setting) <Dipswitch set to OFF>	Continuous mode <Dipswitch set to ON>
Conditions that activate the pump	The BTU requirement is more than 18,600 BTU/h* OR 30 minutes have elapsed after previous operation	The BTU requirement is more than 11,900 BTU/h*
Conditions that deactivate the pump	4 minutes after activation, if the computer detects a BTU requirement of less than 18,600 BTU/h, the computer will stop the pump in 90 seconds.	⚠ **Non-stop pump operation** Once the computer sends an ON signal to the pump, it will never send a STOP signal. The pump will continually run non-stop as long as there is power to the T-K3.

*The computer records the inlet temperature and the flow rate of the pump during the final minute of its previous operation when calculating the BTU requirement.

CAUTION

Running pumps continuously for long durations may damage the T-K3 and can shorten its lifespan. Therefore, running on Continuous mode is not recommended unless there are strong reasons to do so.

12-10. Pump control ON/OFF conditions: BTU requirements for Intermittent mode

A. Calculating the pump's ON/OFF condition

【Condition needed to turn the pump ON】

$(T_{set} - T_{in}) \times GPM \times 500 > 18,600$

【Condition needed to turn the pump OFF】

4 minutes after activation, if the computer detects a BTU requirement of less than 18,600 BTU/h, the computer will stop the pump in 90 seconds.

$(T_{set} - T_{in}) \times GPM \times 500 < 18,600$ or $T_{in} = T_{set}$

Where: T_{set} = Output set temperature and T_{in} = Inlet temperature

B. Calculation example

Set temperature: $T_{set} = 122\,^{\circ}F$ Flow rate = 2.5 GPM

【Condition needed to turn the pump ON】

$(122 - T_{in}) \times 2.5 \times 500 > 18,600$ $T_{in} < 107.1\,^{\circ}F$

【Condition needed to turn the pump OFF】

$(122 - T_{in}) \times 2.5 \times 500 < 18,600$ $T_{in} > 107.1\,^{\circ}F$

C. ON/OFF table (ON values are the same as OFF values)

Set temperature (°F)	Flow rate of pump (GPM)						
	1.0	1.5	2.0	2.5	3.0	3.5	4.0
113	75.8	88.2	94.4	98.1	100.6	102.4	103.7
122	84.8	97.2	103.4	107.1	109.6	111.4	112.7
131	93.8	106.2	112.4	116.1	118.6	120.4	121.7
140	102.8	115.2	121.4	125.1	127.6	129.4	130.7
158	120.8	133.2	139.4	143.1	145.6	147.4	148.7
167	129.8	142.2	148.4	152.1	154.6	156.4	157.7
185	147.8	160.2	166.4	170.1	172.6	174.4	175.7

12-11. Pump control ON/OFF conditions: BTU requirements for Continuous mode (Non-stop pump operation)

A. Calculating the pump's ON/OFF condition

【Condition needed to turn the pump ON】

(T_{set} – Tin) × GPM × 500 > 11,900

【There are no conditions which turn the pump OFF】

⚠ **Non-stop pump operation**

Once the computer sends an ON signal to the pump, it will never send a STOP signal. The pump will continually run non-stop as long as there is power to the T-K3.

B. Calculation example

Set temperature : T_{set} = 122 ˚F Flow rate = 2.5 GPM

【Condition needed to turn the pump ON】

(122 – T_{in}) × 2.5 × 500 > 11,900 T_{in} < 112.5˚F

C. ON table

Set temperature (˚F)	Flow rate of pump (GPM)						
	1.0	1.5	2.0	2.5	3.0	3.5	4.0
113	89.2	97.1	101.1	103.5	105.1	106.2	107.1
122	98.2	106.1	110.1	112.5	114.1	115.2	116.1
131	107.2	115.1	119.1	121.5	123.1	124.2	125.1
140	116.2	124.1	128.1	130.5	132.1	133.2	134.1
158	134.2	142.1	146.1	148.5	150.1	151.2	152.1
167	143.2	151.1	155.1	157.5	159.1	160.2	161.1
185	161.2	169.1	173.1	175.5	177.1	178.2	179.1

12-12 Multi-unit system ON/OFF conditions

In Easy-Link multi-unit systems, the amount of T-K3's called on to activate depends on the **FLOW RATE** and the **OUTPUT SET TEMPERATURE**.

1. Condition required to activate an additional T-K3:

Flow rate required to activate additional T-K3 = A × n

Where **n** = number of currently activated T-K3's

and **A** is dependent on the output set temperature. See table below:

Output set temperature		**Factor "A"**	
°F	°C	GPM	L/min
100 - 122	37 - 50	3.4	13
131	55	3.2	12
140	60	2.9	11
149	65	2.6	10
158 - 167	70 - 75	2.4	9
176 - 185	176 - 185	2.1	8

2. Condition required to reduce the number of activated T-K3's:

A. **In the case of reducing down from 2 T-K3's to 1 T-K3: Flow rate = A / 1.7**

B. **All other cases: Flow rate = A × (n - 2)**

3. Example: Output set temperature = 122°F in a 4-unit system and priority unit is No. 1

To activate additional T-K3's

Unit No.	Flow rate	
	GPM	L/min
No.1 ON	0.52	2.0
No.2 ON	3.4	12.9
No.3 ON	6.8	25.7
No.4 ON	10.2	38.6

To reduce number of activated T-K3's

Unit No.	Flow rate	
	GPM	L/min
No.4 OFF	6.8	25.7
No.3 OFF	3.4	12.9
No.2 OFF	2.0	7.6
No.1 OFF	0.37	1.4

12-13. Relay selection for the pump control connection

The maximum current capacity of T-K3's pump control connection is 1 amp.
Before using any relay with the pump control, please check the specifications of that particular relay to ensure that the current value through the coil will not exceed 1 amp.

For example:
To the right, there is a sample of relay specifications from an arbitrary brochure. You can select either the 120VAC or 240VAC relay, because their current values are less than 1A (1,000mA).

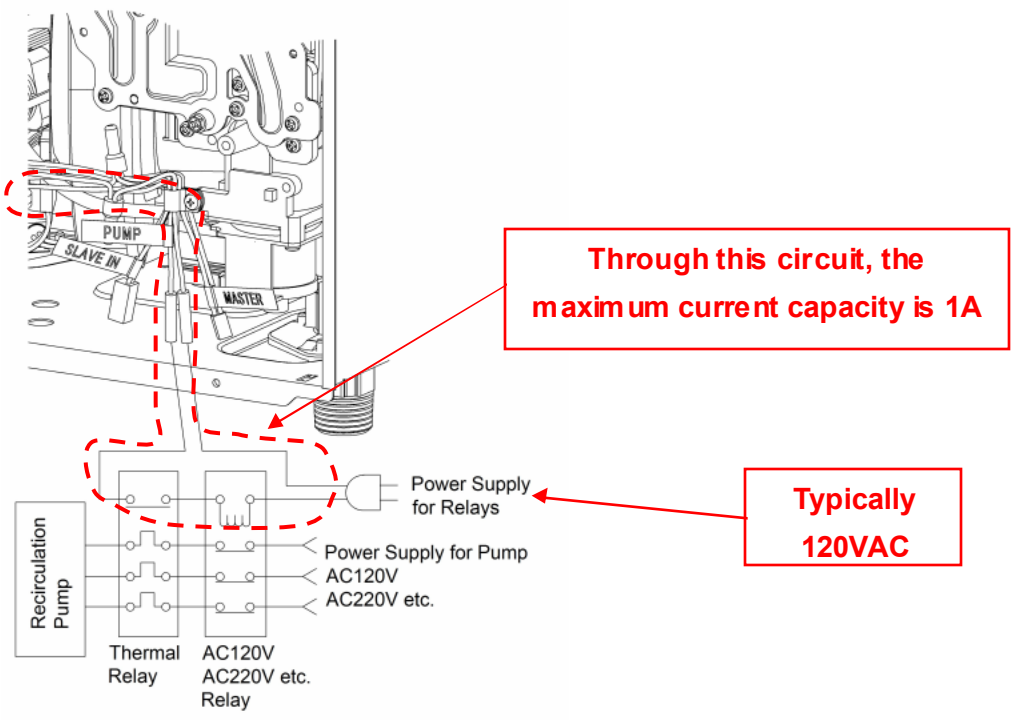
Coil Data @ 25°C

		Nominal Power	Maximum Power
KRP KRPA	AC	2VA	Enclosed Models - 4VA
	DC	1.2W	Enclosed Models - 3W
KA	AC	2VA	Open Models - 4VA
	DC	125mW per movable arm	Open Models - 4W

Duty Cycle: Continuous.
Initial Insulation Resistance: KRP, KRPA - 1000 Megohms, min.
KA - 100 Megohms, min.

Coil Data @ 25°C

	Nominal Voltage	DC Resistance (Ω) ±10%	Nominal Coil Current (mA)
DC Coils	6	32	188
	12	120	100
	24	472	51
	48	1,800	26.6
	110	10,000	11.5
	220	Use 110V relay with 10,000 Ω 5W Resistor in series	
AC Coils	6	6	335
	12	24	168
	24	85	84
	120	2,250	17.5
	240	9,110	8.75



12-14. Adjusting manifold gas pressure

The manifold gas pressure on the T-K3 can be adjusted by following the procedures below.

WARNING

Adjusting the manifold pressure can cause unexpected combustion conditions during operation, which can cause a health hazard, damage the T-K3, and/or shorten its lifespan. Therefore, changing the manifold pressure is not recommended unless there are very strong reasons to do so (e.g. high elevation installations), and with the consultation of Takagi USA.

Adjusting maximum manifold pressure

1. Ensure that T-K3 is not is operation.
2. Remove the screw off the manifold port of the T-K3. (Figure 1)
3. Connect a manometer to the manifold port using a tube (Figure 2). Ensure that this connection is secure enough to prevent gas leak.
4. Run water through the T-K3 to activate its operation. If presence of a gas leak is detected, immediately shut off the T-K3 and inspect the tube/manifold connection; otherwise, proceed onto the next step.
5. Press and hold down the **"MAX"** button on the computer board. While holding down the "MAX" button, press either the **"INCREASE"** or **"DECREASE"** button to increase or decrease the manifold gas pressure, respectively (Figure 3). Refer to the manometer to verify that pressure has been set to desired value.
6. After gas pressure has been set, deactivate the T-K3, remove the manometer tube, and replace the port screw.

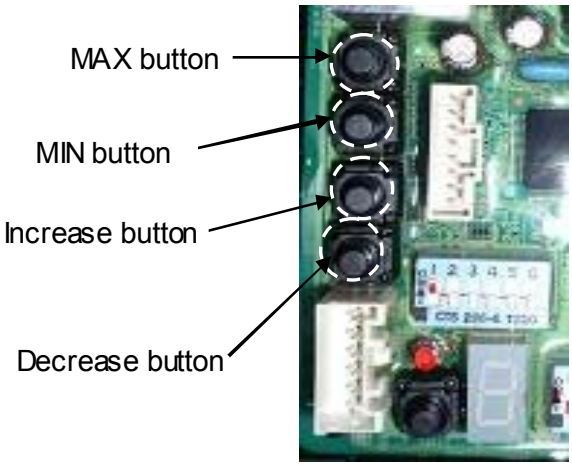
Adjusting minimum manifold pressure

1. Ensure that T-K3 is not is operation.
2. Remove the screw off the manifold port of the T-K3. (Figure 1)
3. Connect a manometer to the manifold port using a tube (Figure 2). Ensure that this connection is secure enough to prevent gas leak.
4. Run water through the T-K3 to activate its operation. If presence of a gas leak is detected, immediately shut off the T-K3 and inspect the tube/manifold connection; otherwise, proceed onto the next step.
5. Press and hold down the **"MIN"** button on the computer board. While holding down the "MIN" button, press either the **"INCREASE"** or **"DECREASE"** button to increase or decrease the manifold gas pressure, respectively (Figure 3). Refer to the manometer to verify that pressure has been set to desired value.
6. After gas pressure has been set, deactivate the T-K3, remove the manometer tube, and replace the port screw.

Figure 1

Figure 2

Figure 3



T-K3 computer board

12-15. Manually adjusting the fan motor speed

While the FM+ dipswitch will automatically increase the fan speed by 6%, the fan motor speed on the T-K3 can also be manually adjusted. In order to perform manual adjustments to the speed, a TM-RE10 or TM-RE30 remote controller is required.

WARNING

Manually adjusting the fan motor speed of the T-K3 will change the amount of intake air for combustion, which can cause excess CO emission from the exhaust chamber if the fan motor speed is set incorrectly. Therefore, this procedure should **never** be performed unless Takagi USA has given consent and authorization.

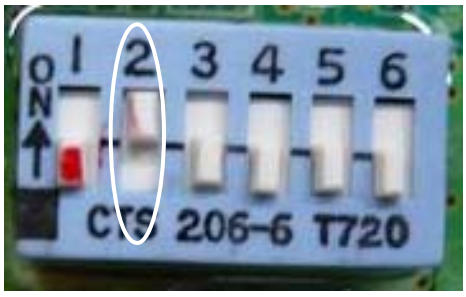
Adjusting maximum fan motor speed

1. While T-K3 is in operation, set dipswitch No.2 to the "ON" position. (Figure 1)
2. On the temperature remote controller, display mode #3 (fan motor speed) by entering the "Diagnostics mode" (Refer to Section 12-1).
3. Press and hold down the **"MAX"** button on the computer board. While holding down the "MAX" button, press either the **"INCREASE"** or **"DECREASE"** button to increase or decrease the fan motor speed, respectively (Figure 2). Refer to the remote controller display to verify that speed has been set to desired value.
4. After fan speed has been set, set dipswitch No.2 back to the "OFF" position.

Adjusting minimum fan motor speed

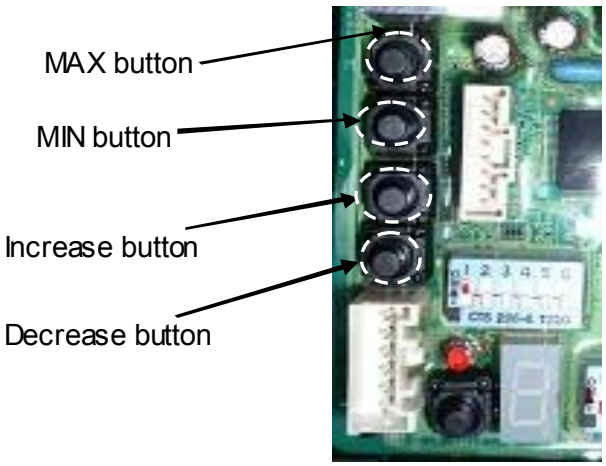
1. While T-K3 is in operation, set dipswitch No.2 to the "ON" position. (Figure 1)
2. On the temperature remote controller, display mode #3 (fan motor speed) by entering the "Diagnostics mode" (Refer to Section 12-1).
3. Press and hold down the **"MIN"** button on the computer board. While holding down the "MIN" button, press either the **"INCREASE"** or **"DECREASE"** button to increase or decrease the fan motor speed, respectively (Figure 2). Refer to the remote controller display to verify that speed has been set to desired value.
4. After fan speed has been set, set dipswitch No.2 back to the "OFF" position.

Figure 1



Dipswitch settings

Figure 2



T-K3 computer board

12-16. Freeze protection system

There are two features to the T-K3's freeze protection system: the automatic firing system and the ceramic heating blocks. The automatic firing system allows the T-K3 to briefly fire on for about 4 seconds and the ceramic heating blocks will heat up whatever portion of the heat exchanger the blocks are strapped to. The firing system mainly focuses on providing freeze protection around the heat exchanger drum. The three heating blocks focus on protecting the inlet and outlet piping inside the T-K3, as well as the front drum pipe. The conditions to activate either feature are different from each other. However, the two features are not mutually exclusive, because they focus on different areas of the T-K3. As long as each particular feature's activation requirements are met, it is possible for both features to operate at the same time.

Automatic firing system

Activation conditions will depend on the on whether or it is an indoor / direct-vent or outdoor installation. Gas and electrical power are required for this feature to operate.

Indoor / direct-vent installation:

After 5 minutes have elapsed since the T-K3's previous firing operation, the computer will continually check the temperatures of the inlet and outlet thermistors (the outlet thermistor is the one that checks the temperature of the water immediately leaving the heat exchanger, not the water leaving the T-K3, which is mixed with water from the bypass valve). The automatic firing system will not activate at all unless these 5 minutes have elapsed.

When the computer checks for these temperatures, the freeze protection firing system will activate if:

$T_{in} \leq 39°F$ and $T_{out} \leq 50°F$ **OR** $T_{out} \leq 37°F$

where T_{in} is the temperature of inlet thermistor and T_{out} is the temperature of the outlet thermistor.

To sum it up in a chart:

5 minutes have elapsed since prior operation?	Inlet thermistor temperature	Outlet thermistor temperature	Will automatic firing be activated?
No	Any	Any	NO
Yes	Above 39°F	Any	NO
Yes	Any	Above 50°F	NO
Yes	39°F and below	50°F and below	YES
Yes	Any	37°F and below	YES

Outdoor installation:

After 25 minutes have elapsed since the T-K3's previous firing operation, the computer will continually check the temperatures of the inlet and outlet thermistors. The automatic firing system will not activate at all unless these 25 minutes have elapsed.

When the computer checks for these temperatures, the freeze protection firing system will activate if:

$T_{in} \leq 37°F$ and $T_{out} \leq 43°F$ **OR** $T_{out} \leq 37°F$

where T_{in} is the temperature of inlet thermistor and T_{out} is the temperature of the outlet thermistor.

To sum it up in a chart:

25 minutes have elapsed since prior operation?	Inlet thermistor temperature	Outlet thermistor temperature	Will automatic firing be activated?
No	Any	Any	NO
Yes	Above 37°F	Any	NO
Yes	Any	Above 43°F	NO
Yes	37°F and below	43°F and below	YES
Yes	Any	37°F and below	YES

Ceramic heating blocks

The blocks will only activate based on what the freeze protection thermostat senses. The thermostat is located on the fan motor, close in vicinity to the inlet and outlet pipes within the T-K3. Electrical power is required for this feature to operate.

The heating blocks will activate if the thermostat senses a surrounding temperature below 36.5°F.

Once they are on, the heating blocks will only deactivate if surrounding temperatures reach above 46.4°F.

12-17. Freeze protection for recirculation systems

If the T-K3 pump control is used to control a recirculation pump, when needed, the computer will activate this pump to provide flow and prevent freezing throughout the recirculation system.

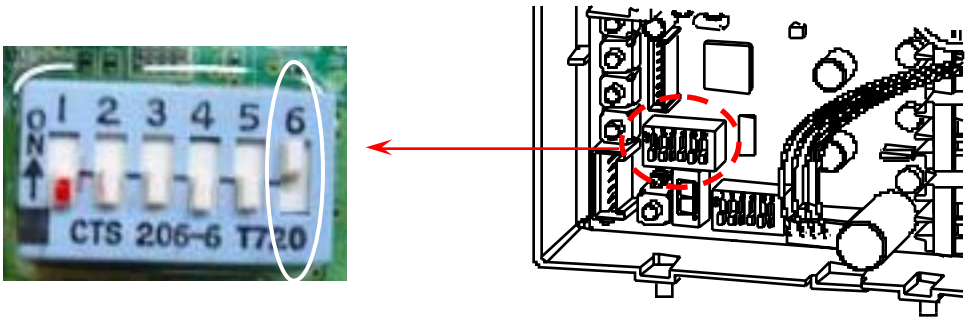
For instructions on connecting the recirculation pump to the pump control port on the T-K3 computer board, refer to Section 12-13 "Relay selection for the pump control connection".

To use this feature in a multiple-unit Easy-link system, the pump must be connected to the T-K3 pump control port in the Master unit. Refer to Section 12-13 for details.

< While recirculation system freeze protection is in operation>
While this freeze protection is operating, the T-K3 computer board will not display anything on its 7-seg LED. In addition, the TM-RE10 and TM-RE30 remote controllers will also not display anything on its screen (this is true whether the T-K3 is in a single-unit installation or a multi-unit Easy-link installation).

A. Activation conditions (all 3 conditions must occur):

1. The T-K3 is in non-operation (no call for hot water).
2. Dipswitch No.6 (the upper bank) on the T-K3 computer board is set to the "**ON**" position.



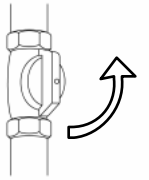
3. The T-K3 computer (of the master unit) detects water temperature 50°F (10°C) or below (the computer will activate the pump every two minutes to properly measure water temperatures throughout the recirculation line).

B. Deactivation condition:

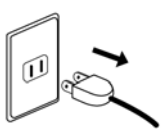
After pump has been activated for freeze protection, the pump is set to run for at least 1 hour. After 1 hour has elapsed, the T-K3 computer (of the master unit) will actively measure water temperature. Pump will deactivate if temperatures remain above 50°F (10°C) continuously for 10 minutes.

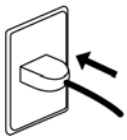
12-18. Draining the T-K3 and cleaning the inlet water filter

1. Close the manual gas shut off valve.

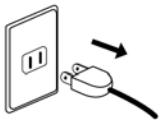


2. Turn off power to the T-K3, and then turn on again.

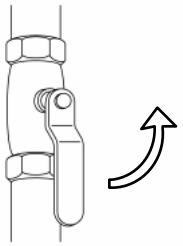




3. Wait 30 seconds for water valves to completely open. Then turn off power to the T-K3, yet again.

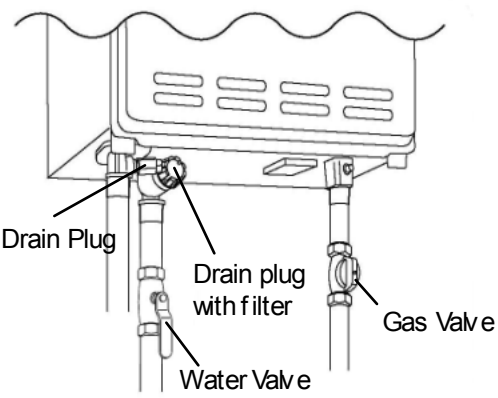


4. Close the water shut-off valve.



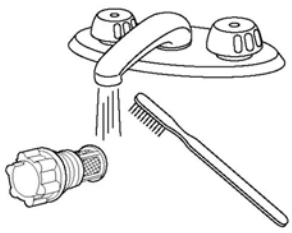
5. Open all hot water taps in the house. When the all water flow has ceased, close all hot water taps.

6. Have a bucket or pan to catch the water from the T-K3's drain plugs. **Unscrew** the drain plugs to drain all the water out of the T-K3.



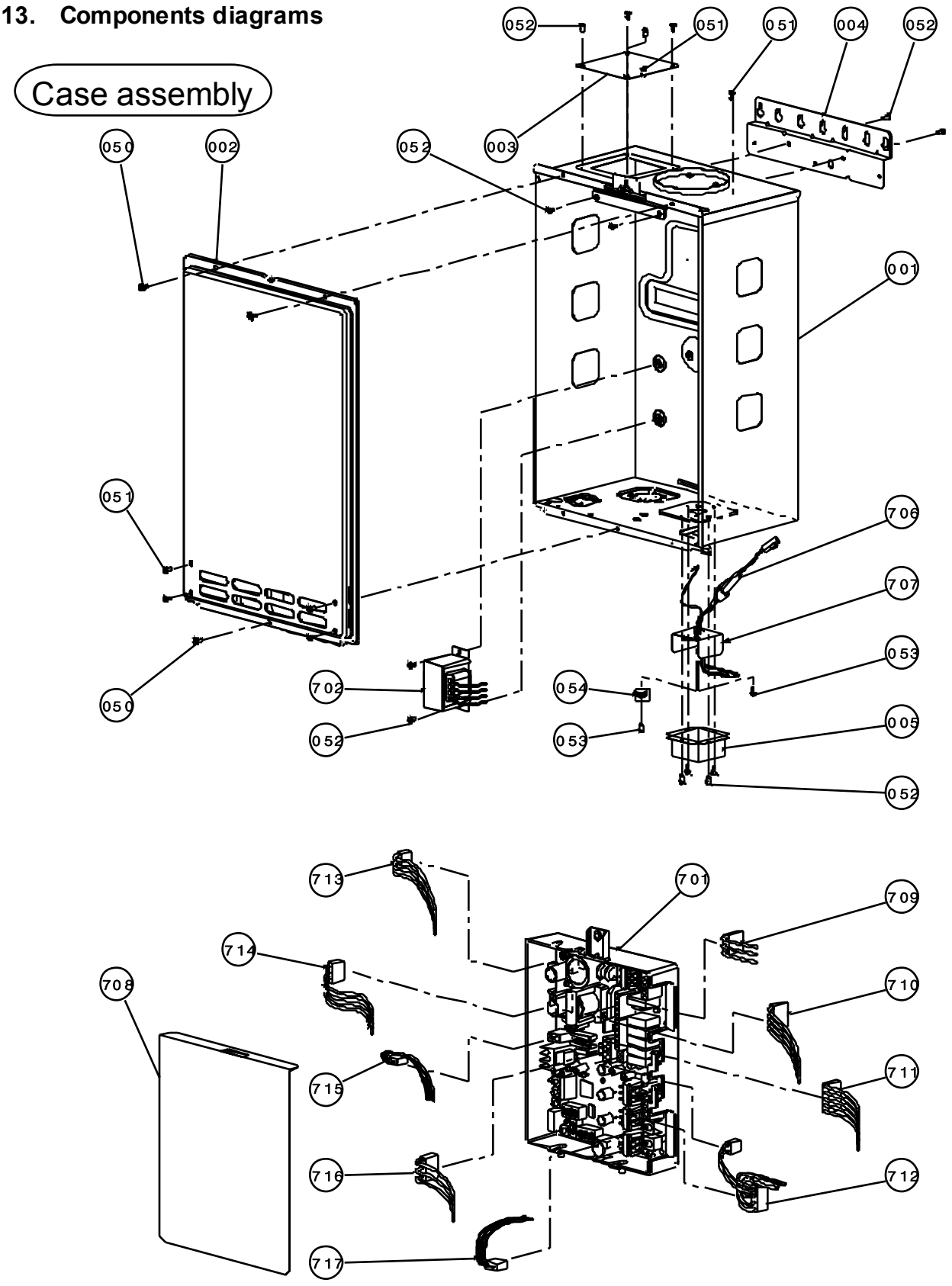
7. Wait a few minutes to ensure all water has completely drained from unit.

8. **Clean the filter:** Inspect the water filter located within the cold inlet. With a tiny brush, clean the water filter of any debris which may have accumulated and reinsert the filter back into the cold water inlet.

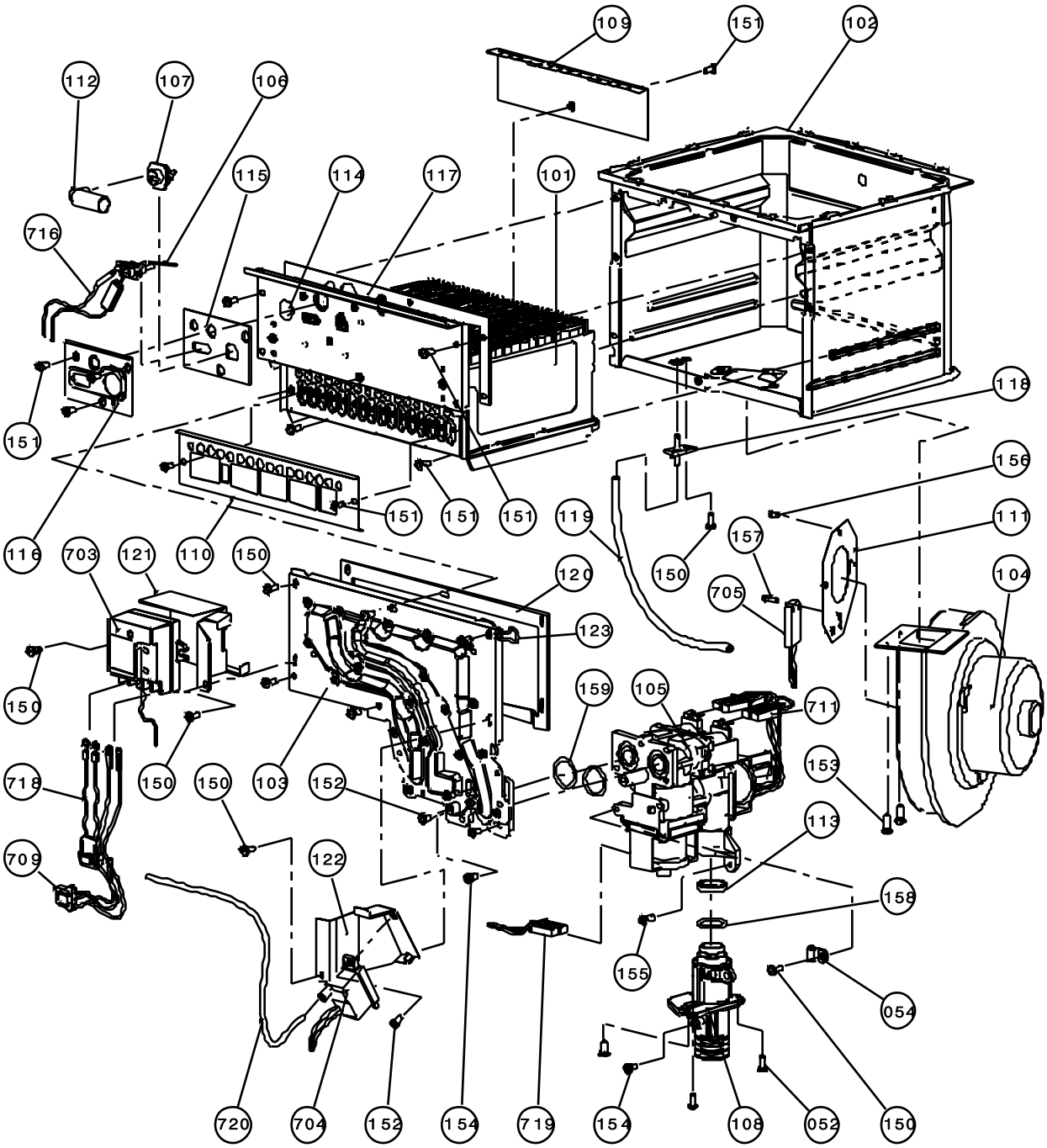


Securely screw the drain plugs back into place. **Hand- tighten only.**

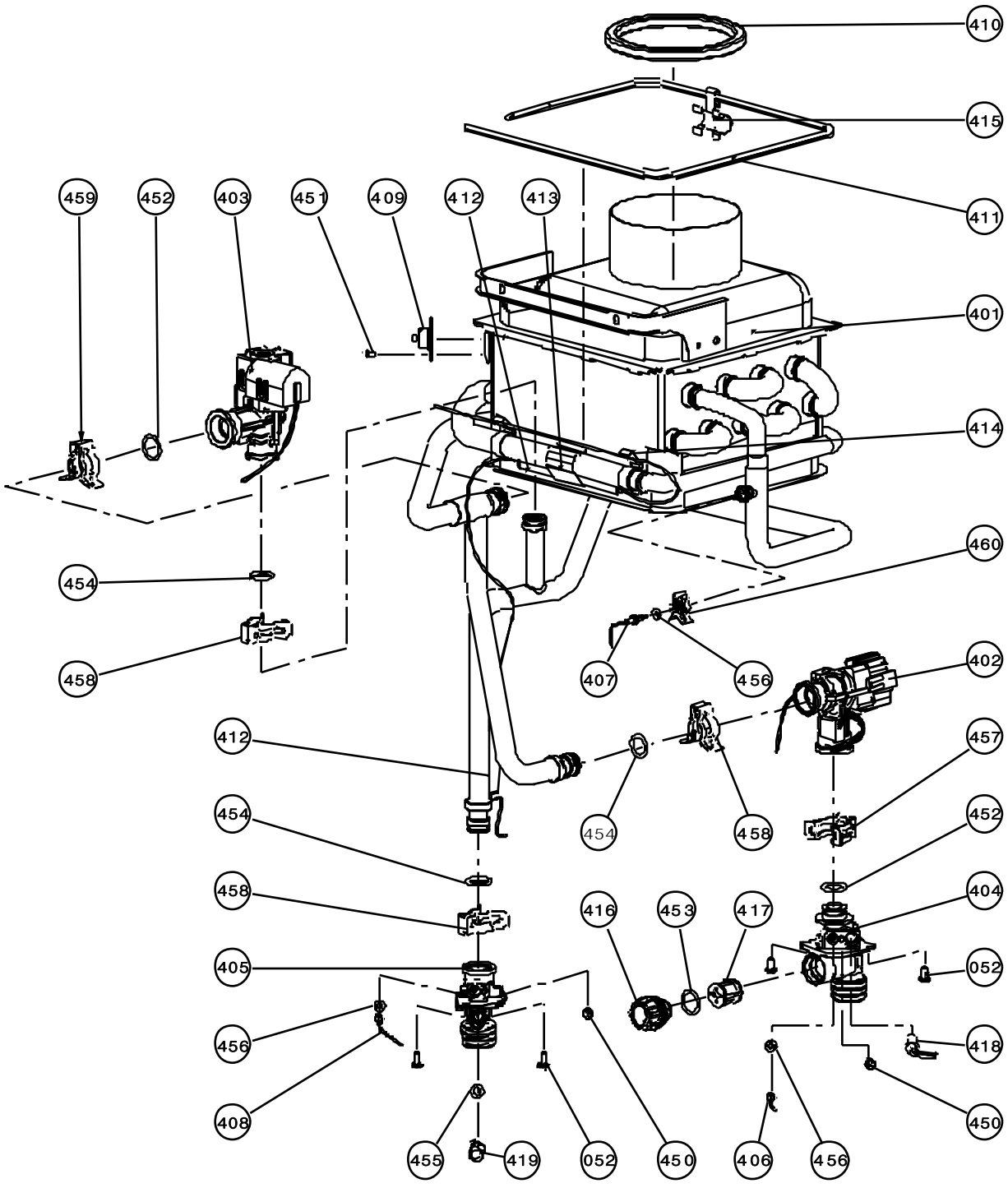
13. Components diagrams



Burner assembly



Water way assembly



14. Parts list

Item #	Part #	Description	Common parts for other units
1	EKK1D	CASE ASSEMBLY	
2	EKK1J	FRONT COVER	
3	EKJ62	AIR BLOCKAGE PLATE	TKJr
4	EKJ09	BRACKET	TKJr
5	EKJ64	JUNCTION BOX	TKJr
50	EW000	SCREW M4X12	TKJr, OS, SP, TH1
51	EW001	SCREW W/WASHER M4X10	TK2, TKD20, TK1S, OS, SP, TM1, TM199, TH1
52	EW002	COATING SCREW M4X10	TK2, TKD20, TK1S, OS, SP, TM1, TM199, TH1
53	EW003	SCREW M4X10	TK2, TKD20, TKJr, TK1S, OS, SP, TM1, TM199, TH1
54	EC00X	NYLONE CLAMP	TH1
101	EKK1N	BURNER ASSEMBLY	SP
102	EKK1Y	COMBUSTION CHAMBER	SP
103	EKK1F	MANIFOLD	
104	EKK25	FAN MOTOR	SP
105	EKK1W	GAS VALVE ASSEMBLY	OS, SP
106	EKK0E	FLAME ROD	
107	EKK0F	IGNITER ROD	
108	EKK1E	GAS INLET	OS, SP
109	EKK34	BURNER PLATE	OS, SP
110	EKK1P	DAMPER	SP
111	EK270	FAN DAMPER	
112	EKN61	ROD CAP	TKJr, TK1S, OS, SP, TH1
113	EKK2Z	GAS INLET RING	OS, SP
114	EKK2V	BURNER WINDOW	OS, SP
115	EKK2W	ROD HOLDER GASKET	OS, SP
116	EKK32	ROD HOLDER	OS, SP
117	EKK0G	BURNER HOLDER GASKET	OS, SP
118	EKK2D	PRESSURE PORT	SP
119	EKK2N	URETHAN TUBE	SP
120	EKK2Y	MANIFOLD GASKET	OS, SP
121	EKK20	GFI PLATE	
122	EKK1B	IGNITER PLATE	
123	EM167	WIRE CLAMP 60	TK2, TKD20, TKJr, TK1S, OS, SP, TM1, TM199, TH1
150	EW003	SCREW M4X10	TK2, TKD20, TKJr, TK1S, OS, SP, TM1, TM199, T-H1
151	EW002	COATING SCREW M4X10	TK2, TKD20, TKJr, TK1S, OS, SP, TM1, TM199, T-H1
152	EKK37	SCREW M4X12	OS, SP
153	EW004	HEX HEAD SCREW M4X12	TK2, TKD20, SP, TH1
154	EW005	HEX HEAD SCREW M4X8	TK2, TKD20, OS, SP, TH1
155	EW006	SCREW M4X10	TK2, TKD20, OS, SP, TH1
156	EW00B	SCREW M3X8	SP
157	EW008	SCREW M3X10	TK2, TKJr, TK1S, OS, SP, TM1, TM199
401	EKK1X	HEAT EXCHANGER ASSEMBLY	
402	EKK0T	FLOW ADJUSTMENT VALVE W/FLOW SENSOR	
403	EKK0U	BYPASS VALVE	
404	EKK1U	WATER INLET	OS, SP
405	EKK1V	WATER OUTLET	OS, SP

Item #	Part #	Description	Common parts for other units
406	EKK38	INLET THERMISOR	
407	EKK2T	OUTLET THERMISTOR	
408	EKK1A	MIXING THERMISTOR	
409	EKN34	HI-LIMIT SWITCH	TKJr, TK1S, OS, SP, TH1
410	EKN50	SILICON RING	T-K1S,T-K3,T-K3-SP,T-H1
411	EKK0S	OVER HEAT CUT OFF FUSE	OS, SP
412	EKK2R	HEATER	OS, SP
413	EKK27	PIPE HEATER FIXING PLATE	OS, SP
414	EKK26	FUSE FIXING PLATE 18	OS, SP
415	EK029	FUSE FIXING PLATE 14	OS, SP
416	EKK2B	INLET DRAIN PLUG	OS, SP
417	EKK2C	INLET WATER FILTER	OS, SP
418	EKK2P	INLET HEATER	OS, SP
419	EKK2E	OUTLET DRAIN PLUG	OS, SP
450	EW009	SCREW M4X6	OS, SP
451	EW00A	SCREW M3X6	TK2, TKD20, TKJr, TK1S, OS, SP, TM1, TM199, TH1
452	EZM16	O-RING P16 EPDM	TK2, TKD20, TKJr, TK1S, OS, SP, TM1, TM199, TH1
453	EZM15	O-RING P15 EPDM	TKJr, TK1S, OS, SP, TH1
454	EZM14	O-RING P14 EPDM	OS, SP
455	EZM06	O-RING P6 EPDM	TK2, TKD20, TKJr, TK1S, OS, SP, TM1, TM199, TH1
456	EZM04	O-RING P4 EPDM	TK2, TKD20, TKJr, TK1S, OS, SP, TM1, TM199, TH1
457	EM192	FASTENER 16A	TK2, TKD20, TKJr, TK1S, OS, SP, TM1, TM199, TH1
458	EKK24	FASTENER 14-22	OS, SP
459	EKK39	FASTENER 16-25A	OS, SP
460	EKH30	FASTENER 4-11	TH1
701	EKK1L	COMPUTER BOARD	
702	EKH09	TRANSFORMER	TH1, OS, SP
703	EKN73	GFI	TKJr, TK1S, TH1
704	EKN74	IGNITER	TKJr, TK1S, OS, SP, TH1
705	EKJ59	FREEZE PROTECTION THERMOSTAT	TKJr, TK1S, OS, SP
706	EKN37	FUSE ASSEMBLY	TKJr, TK1S, OS, SP, TH1
707	EKJ66	FUSE BOX	TKJr, TK1S, OS, SP
708	EKK1M	COMPUTER BOARD COVER	
709	EKK0D	AC100V WIRE	
710	EKK0Z	EH-IG WIRE	
711	EKK10	GAS VALVE WIRE	
712	EKK36	PUMP AND MULTI CABLE	
713	EKK25	FAN MOTOR CABLE	
714	EKK35	RS-VG WIRE	
715	EKK33	WATER VALVES WIRE	
716	EKK11	FLAME ROD WIRE	
717	EKK1Z	THERMISTORS WIRE	
718	EKK0B	TRANSFORMER WIRE	
719	EKK12	PROPORTIONAL GAS VALVE WIRE	
720	EKK2M	HIGH VOLTAGE IGNITER WIRE	OS, SP

15. Revisions

Version	Description of changes	Date
1.00	Sample evaluation	10/19/07
1.01	Revision of w rong information in the section 10,11 and 12	10/28/07
1.02	Revision of w rong information in all section	11/28/07
1.03	Revised by P.P.	1/14/08
1.04	Revised by P.P.	2/20/08
1.05	Revised by the R&D and Takagi Japan	3/4/08